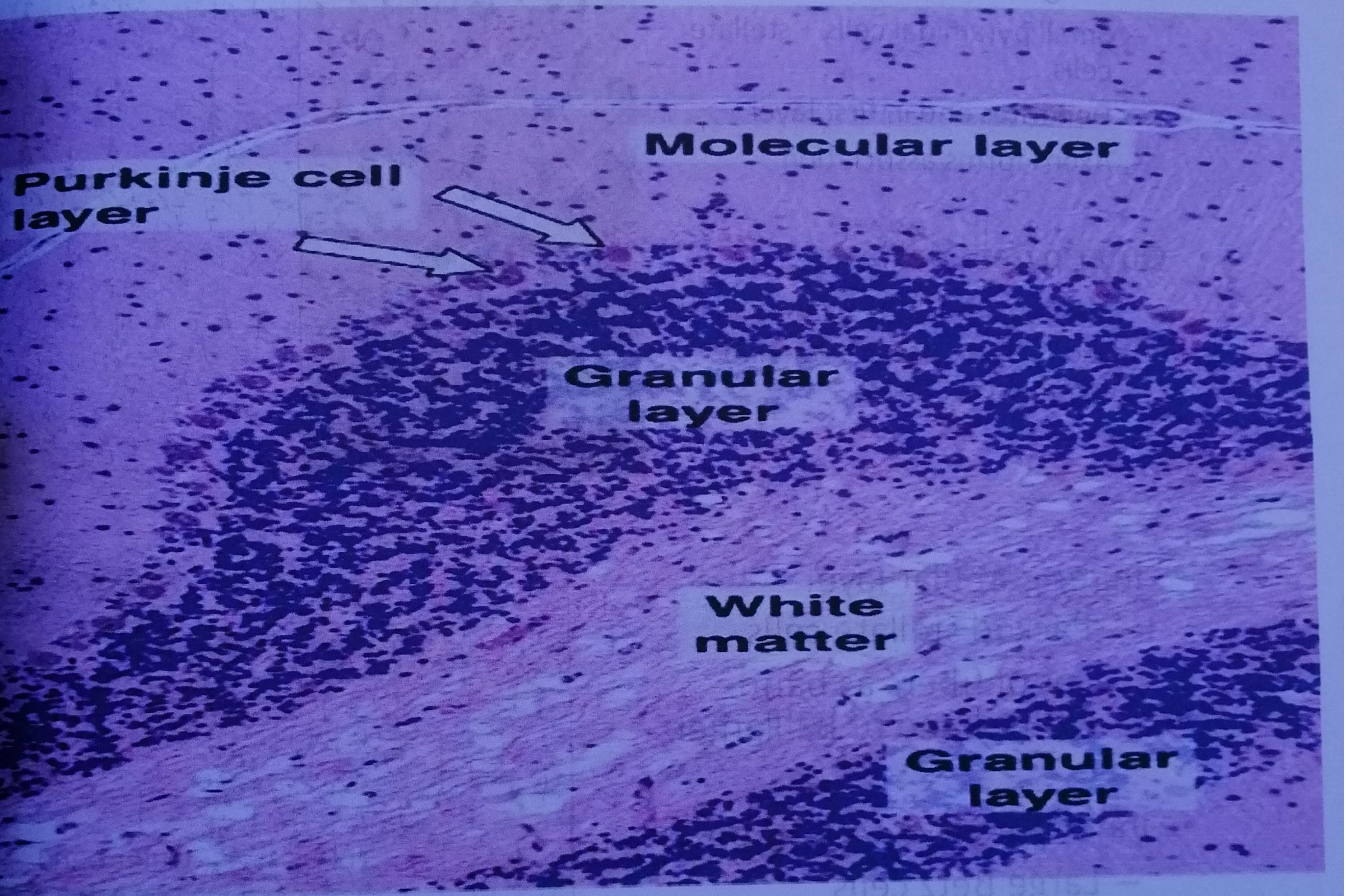
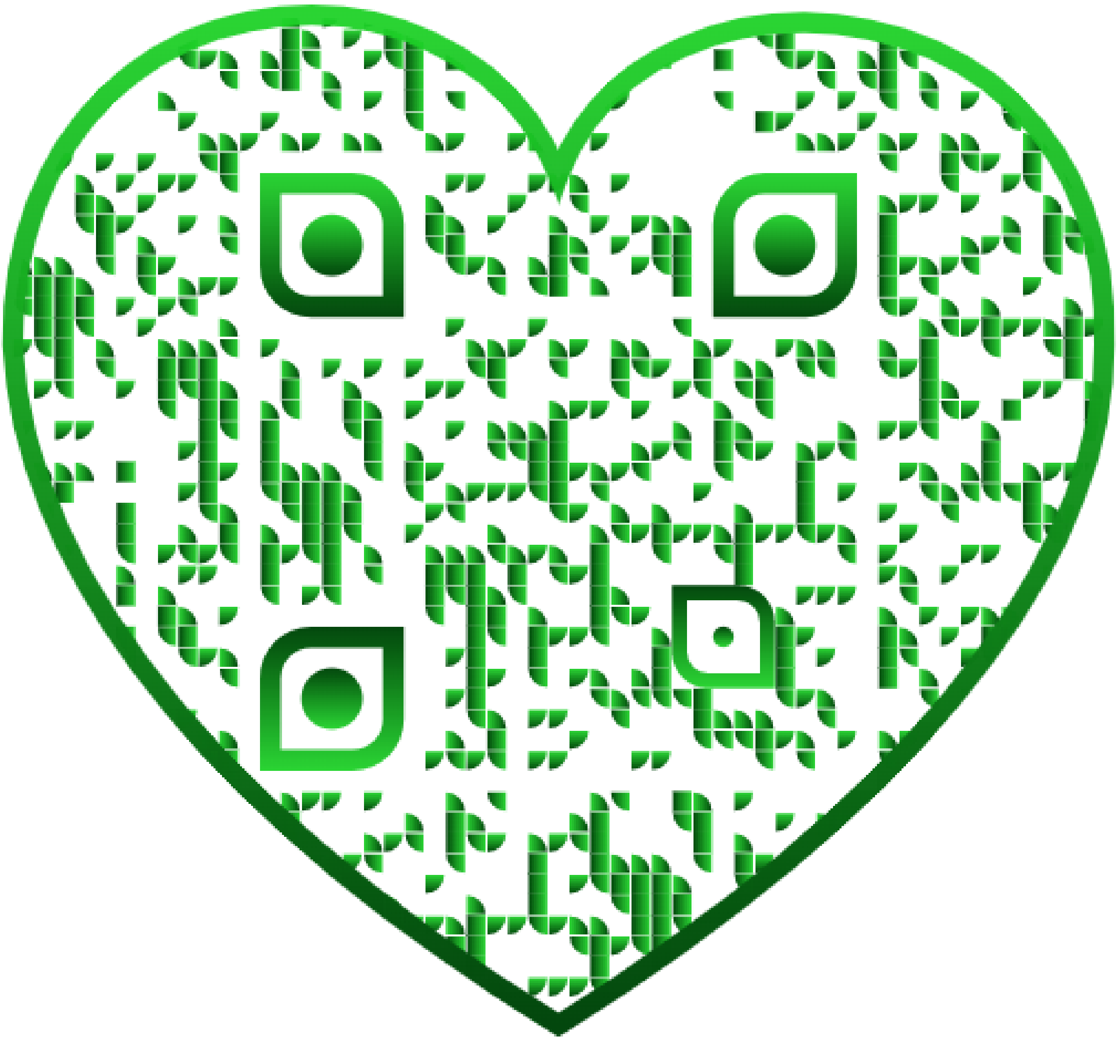
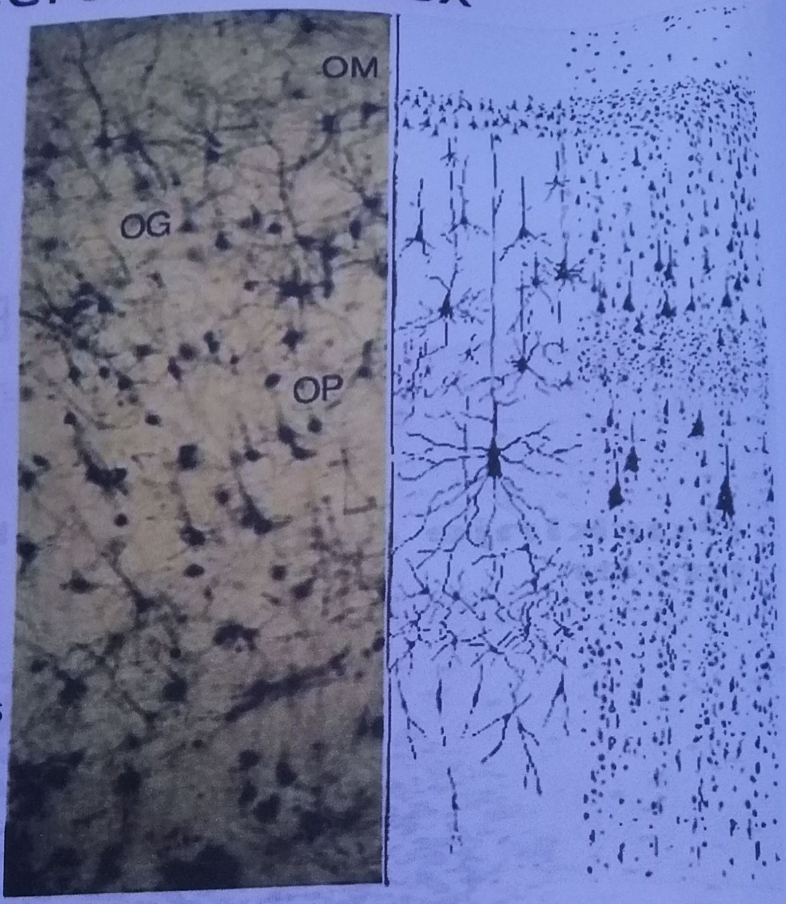
CEREBELLUM

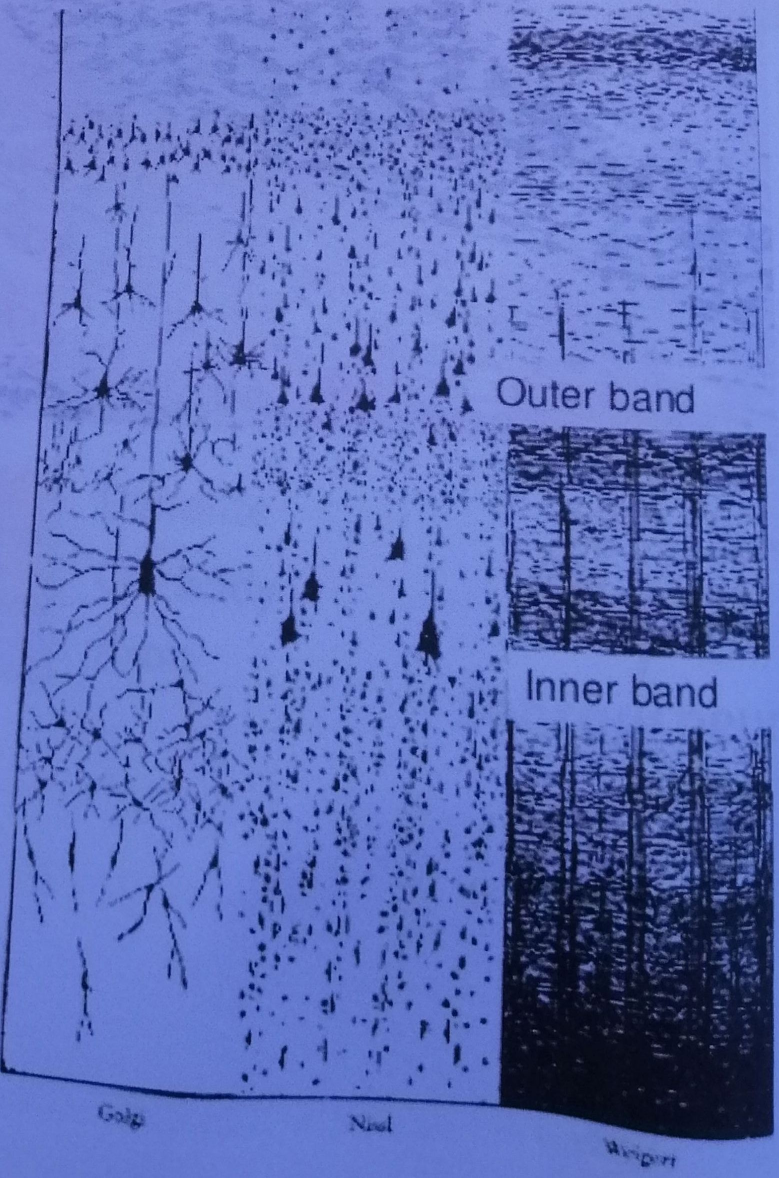

Molecular layer
Purkinje cell layer
Granular layer
White matter
Granular layer



Layers of cerebral cortex



- Outer Molecular layer
  - Horizontal cells + Golgi type II
  - Tangential nerve fibers from pyramidal, fusiform and cells of Mortinotti
- Outer granular layer
  - Small pyramidal cells + stellate cells
  - Dendrites end in first layer
  - Axons forms association
- Outer pyramidal layer
  - Medium and large pyramidal cells
  - Axons forms association and commissural fibers



- Inner granular layer
  - Packed stellate cells
  - Lot of fibers as band- Outer band of Baillarger
- Inner pyramidal/ganglion
  - Large Betz cells
  - Axons continues as projection fibers
  - Horizontal fibers forms inner band of Baillarger
- Multiform layer/fusiform cells
  - Spindle shaped cells
  - Granular, fusiform and stellate type

Nervous system

-Nervous system consists of :-

1-Central nervous system: brain and spinal cord.

2-Peripheral nervous system: 12paired cranial nerves and 31paired spinal nerves.

3-Autonomic nervous system: sympathetic and parasympathetic.

*Embryonic development of the CNS:

-It is developed from neural tube which is ectodermal in origin.

-Ectodermal layer → Neural layer → Neural groove → Neural tube.

*Notes:-

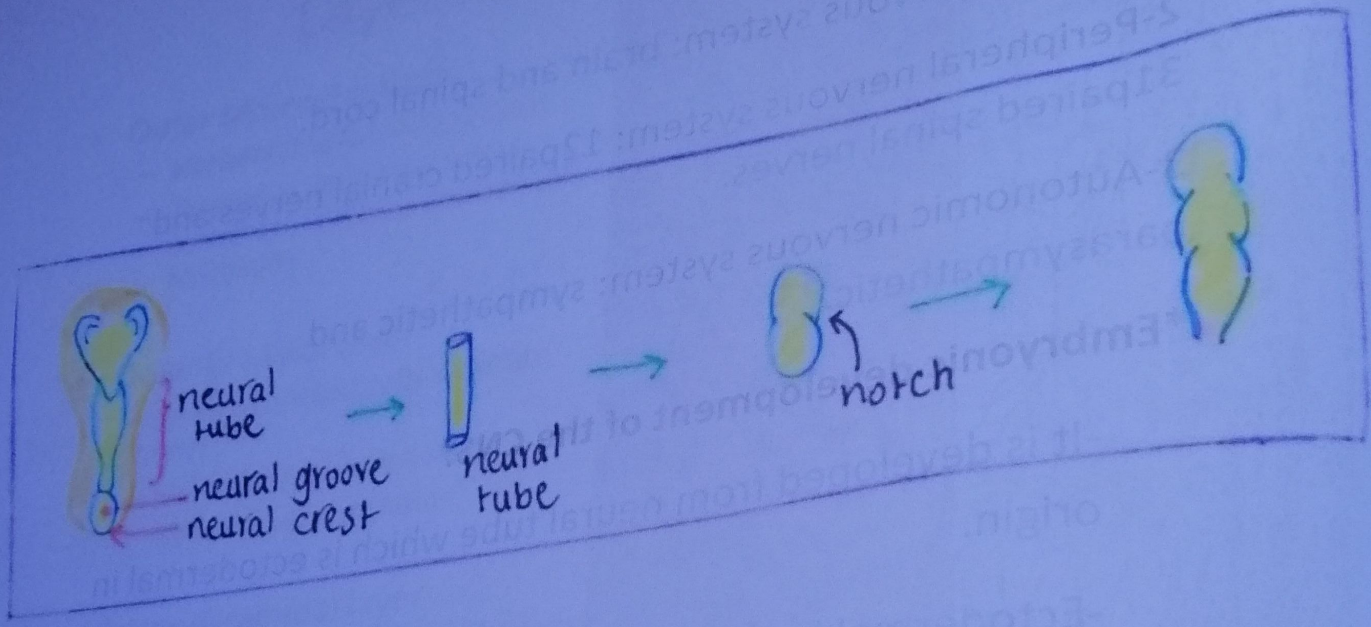
-During the formation of the neural tube, there are detached forming cells called "Neural Crest Cells".

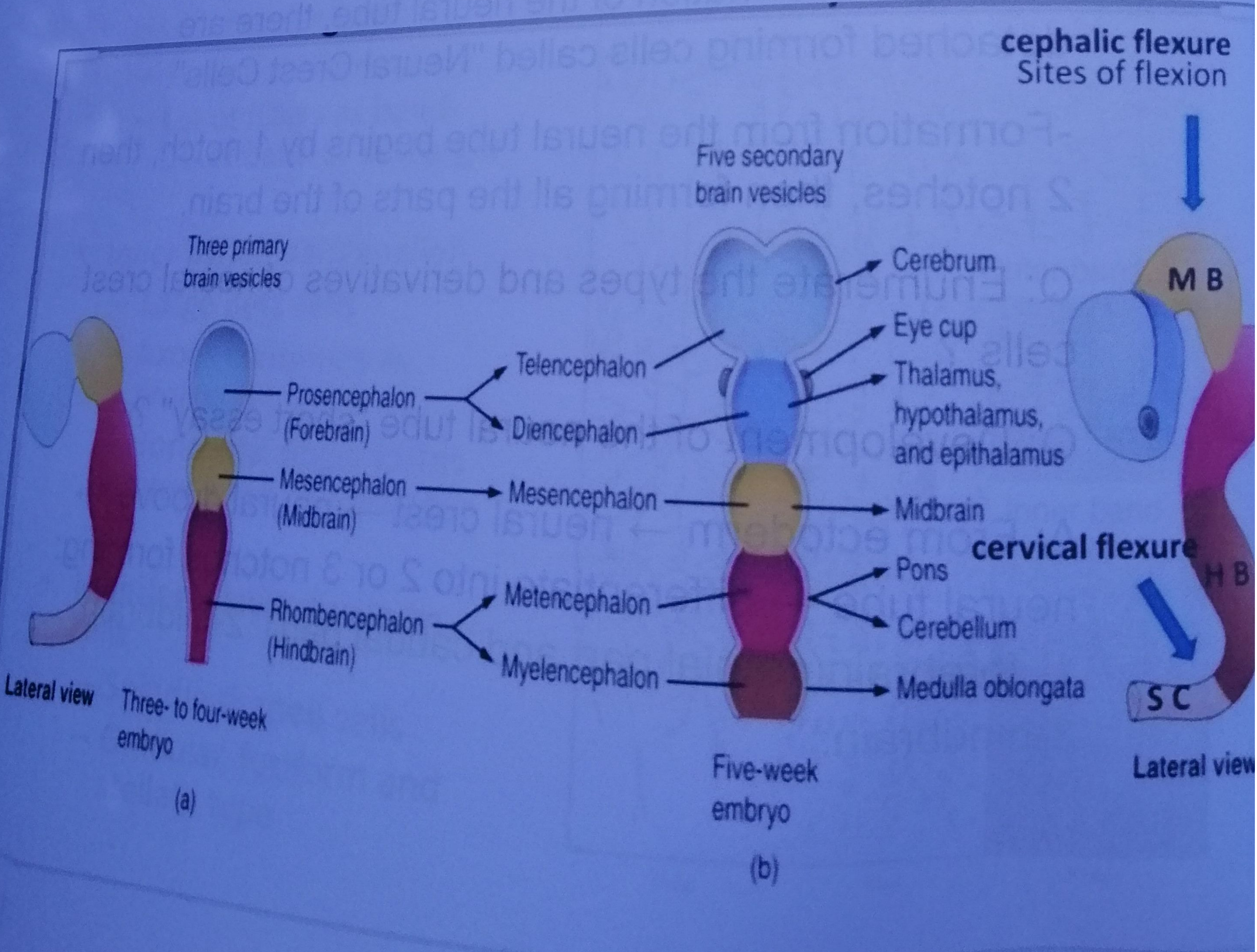
-Formation from the neural tube begins by 1 notch, then 2 notches, then forming all the parts of the brain.

Q: Enumerate the types and derivatives of neural crest cells ?

Q: Development of the neural tube "short essay" ?

A: From ectoderm → neural crest → neural groove → neural tube → differentiate into 2 or 3 notches forming:
1- forebrain(cranial part and caudal part). 2-midbrain. 3-hindbrain.


neural tube
neural groove
neural crest
neural tube
notch


cephalic flexure
Sites of flexion
Five secondary brain vesicles
Three primary brain vesicles
Cerebrum
Eye cup
Thalamus, hypothalamus, and epithalamus
Telencephalon
Prosencephalon (Forebrain)
Diencephalon
Mesencephalon (Midbrain)
Mesencephalon
Midbrain
Pons
cervical flexure
Rhombencephalon (Hindbrain)
Metencephalon
Cerebellum
Myelencephalon
Medulla oblongata
M B
H B
S C
Lateral view
Three- to four-week embryo
(a)
Five-week embryo
(b)
Lateral view

Blood supply of the C.N.S (brain and spinal cord)

- Blood supply of the brain by two sources:

1- Anterior source(pair of ICA).

2-Posterior source(pair of vertebral a.)

*The ICA gives these branches:

1- Ant. Cerebral a.

2- Middle cerebral a.

3- Post. Communicating a.

4- Ant. Choroidal a.

*Vertebral a. branches:

1- Post. Inf. cerebellar a.

2-Ant. and post. spinal a.

3-Medullary branches.

→ the two vertebral arteries join together forming the basilar artery which gives the following branches (from down upward):

1- Ant. inf. cerebellar a.

2- Pairs of pontine a.

3-Sup. cerebellar a.

4- post. cerebral a.

-Blood supply of the cerebrum:

1- Ant. cerebral a.

2- Middle cerebral a.

3-post. cerebral a.

-Blood supply of the cerebellum:

1-sup.cerebellar a. (branch of basilar a.).

2-Ant. inf. Cerebellar a.(branch of basilar a.).

3-Post. inf. Cerebellar a.(branch of vertebral a.).

-Blood supply of the medulla oblongata:

Medullary artery(branch from vertebral a.).

-Blood supply of the pons:

Pairs of pontine artery (from basilar a.)

***Note:**

-ICA enters the CNS through the carotid canal.

-Vertebral arteries pass through the vertebral canal and foramina magnum.

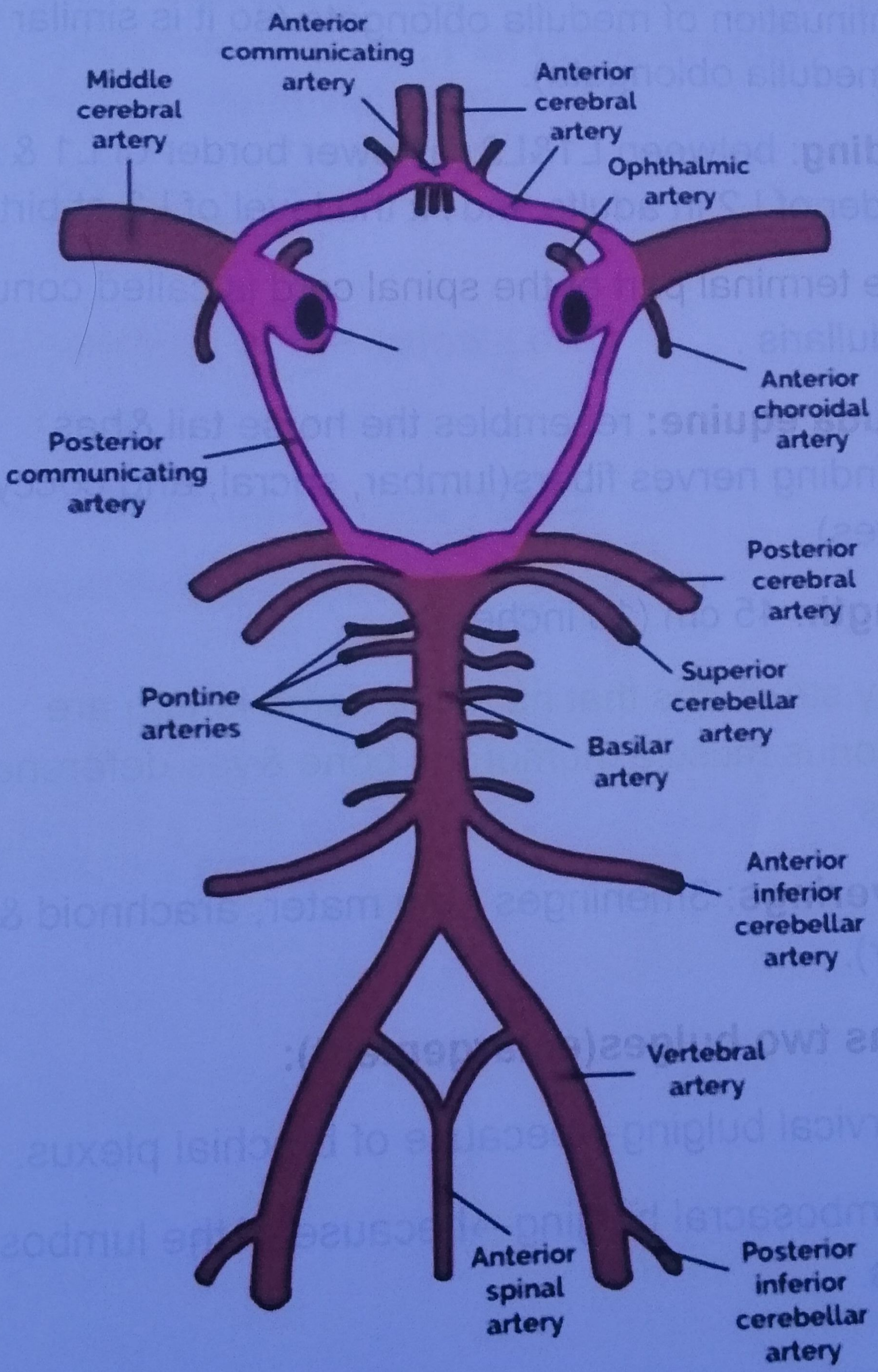
-Blood supply of the spinal cord by 4 sources:

1-Ant. spinal a. → supplies ant. 2/3 of the spinal cord).

2- Two post . spinal arteries→supply post. 1/3 of the spinal cord.

3-Radicular arteries(cervical, thoracic, lumbar &sacral).

4-Segmental arteries (Rt&Lt) →anastmose with each other and each artery supply a segment.


Anterior communicating artery
Middle cerebral artery
Anterior cerebral artery
Ophthalmic artery
Anterior choroidal artery
Posterior communicating artery
Posterior cerebral artery
Superior cerebellar artery
Pontine arteries
Basilar artery
Anterior inferior cerebellar artery
Vertebral artery
Anterior spinal artery
Posterior inferior cerebellar artery

spinal cord

-Definition: it is the inferior part of CNS situated in the vertebral canal.

-Beginning: below the foramina magnum as a continuation of medulla oblongata (so it is similar to that of medulla oblongata).

Ending: between L1&L2 (at lower border of L1 & upper border of L2 in adults and At the level of L3 at birth).

-The terminal part of the spinal cord is called conus medullaris .

-Cauda equine: resembles the horse tail &has extending nerves fibers(lumbar, sacral, and coccygeal nerves).

-Length: 45 cm (18 inches).

-Body structures that have the same length are (Sartorius muscle, humorous bone &vas deference in males.

- **Coverings**: 3meninges (pia mater, arachnoid & dura mater).

- It has two bulges(enlargement):

1- Cervical bulging→because of brachial plexus.

2- Lumbosacral bulging→because of the lumbosacral plexus.

-Development:

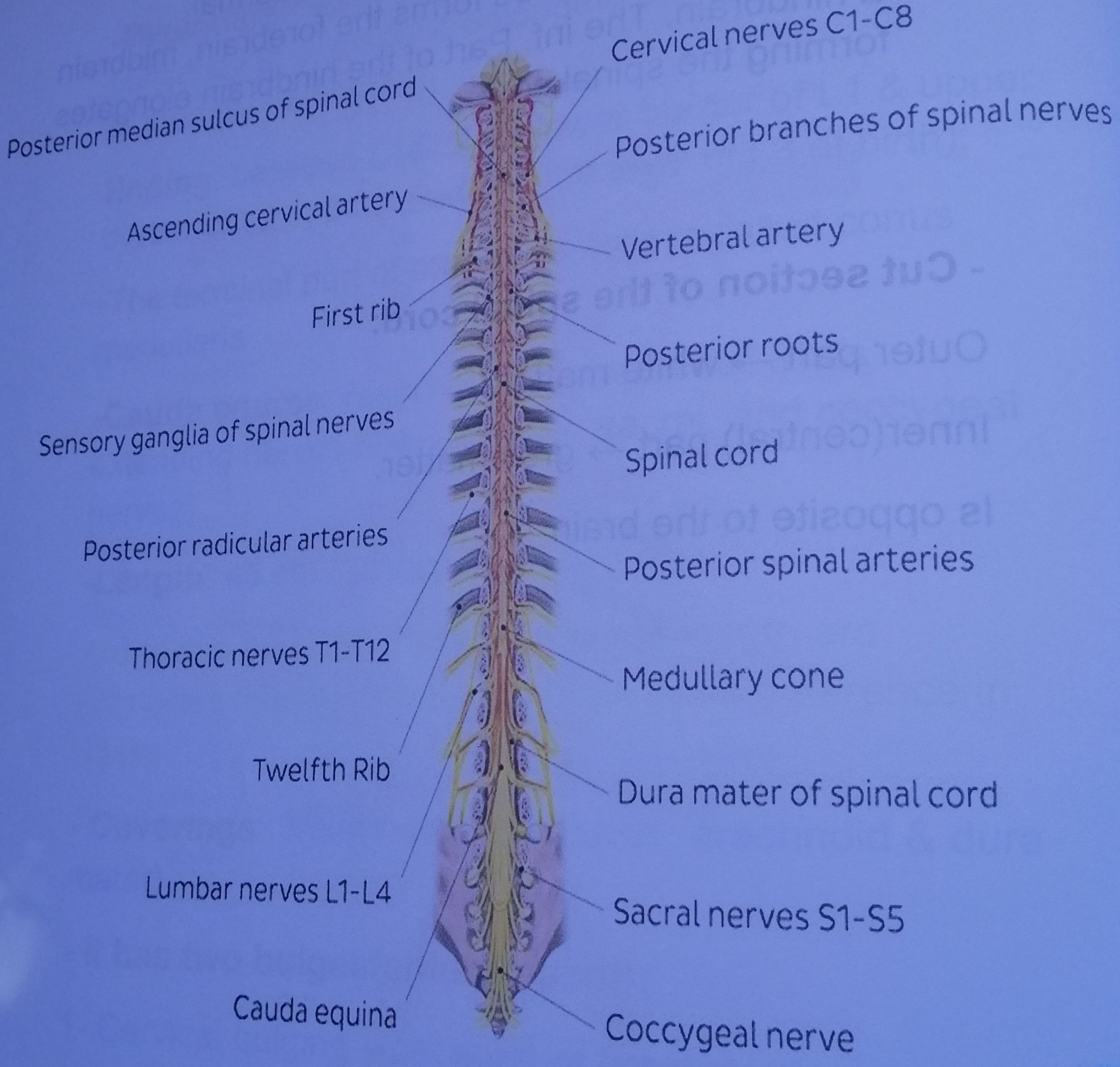
Like the brain, it is developed from the neural tube(which originates from the ectodermal layer).The neural tube forms the forebrain, midbrain & hindbrain. The inf. Part of the hindbrain elongates forming the spinal cord.

- Cut section of the spinal cord:

Outer part → white matter.

Inner(central) part → grey matter.

Is opposite to the brain


Posterior median sulcus of spinal cord
Ascending cervical artery
First rib
Sensory ganglia of spinal nerves
Posterior radicular arteries
Thoracic nerves T1-T12
Twelfth Rib
Lumbar nerves L1-L4
Cauda equina
Cervical nerves C1-C8
Posterior branches of spinal nerves
Vertebral artery
Posterior roots
Spinal cord
Posterior spinal arteries
Medullary cone
Dura mater of spinal cord
Sacral nerves S1-S5
Coccygeal nerve

© www.kenhub.com

Internal structures:

1-Central part(gray matter):

-H-shaped.

-Has 4 horns (2anterior & 2 posterior).

-Form the horns of the gray matter and the ventral & dorsal roots of spinal cord which join each other to form the spinal nerve.

*Spinal ganglia: bulging on the dorsal root of the spinal nerve.

-The ant. part of gray matter →contains descending fibers(motor).

-The post. part of gray matter →contains ascending fibers(sensory).

2- Outer part (white matter):

It is made of three columns:

1- Ant. column (for passage of descending fibers).

2-Post. column (for passage of ascending fibers).

3-2 lat. Columns divided into:

Ant. : for passage of descending fibers.

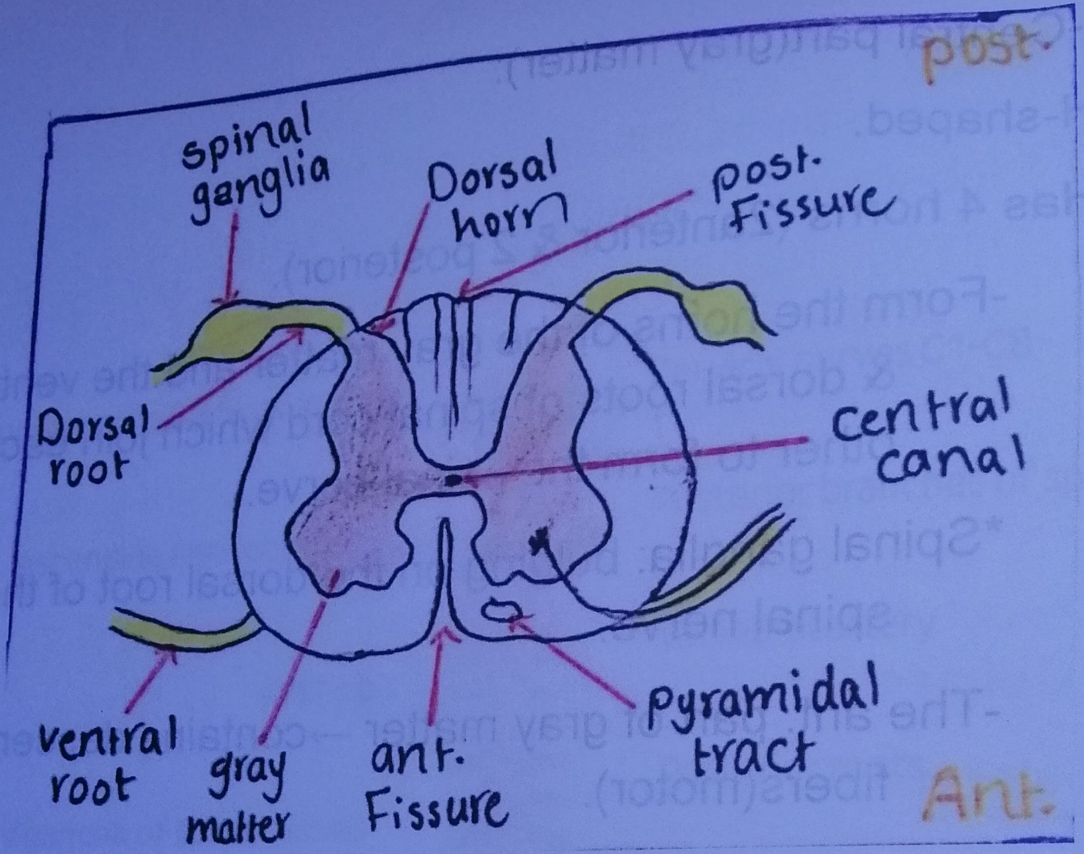
Post.: for passage of ascending fibers.

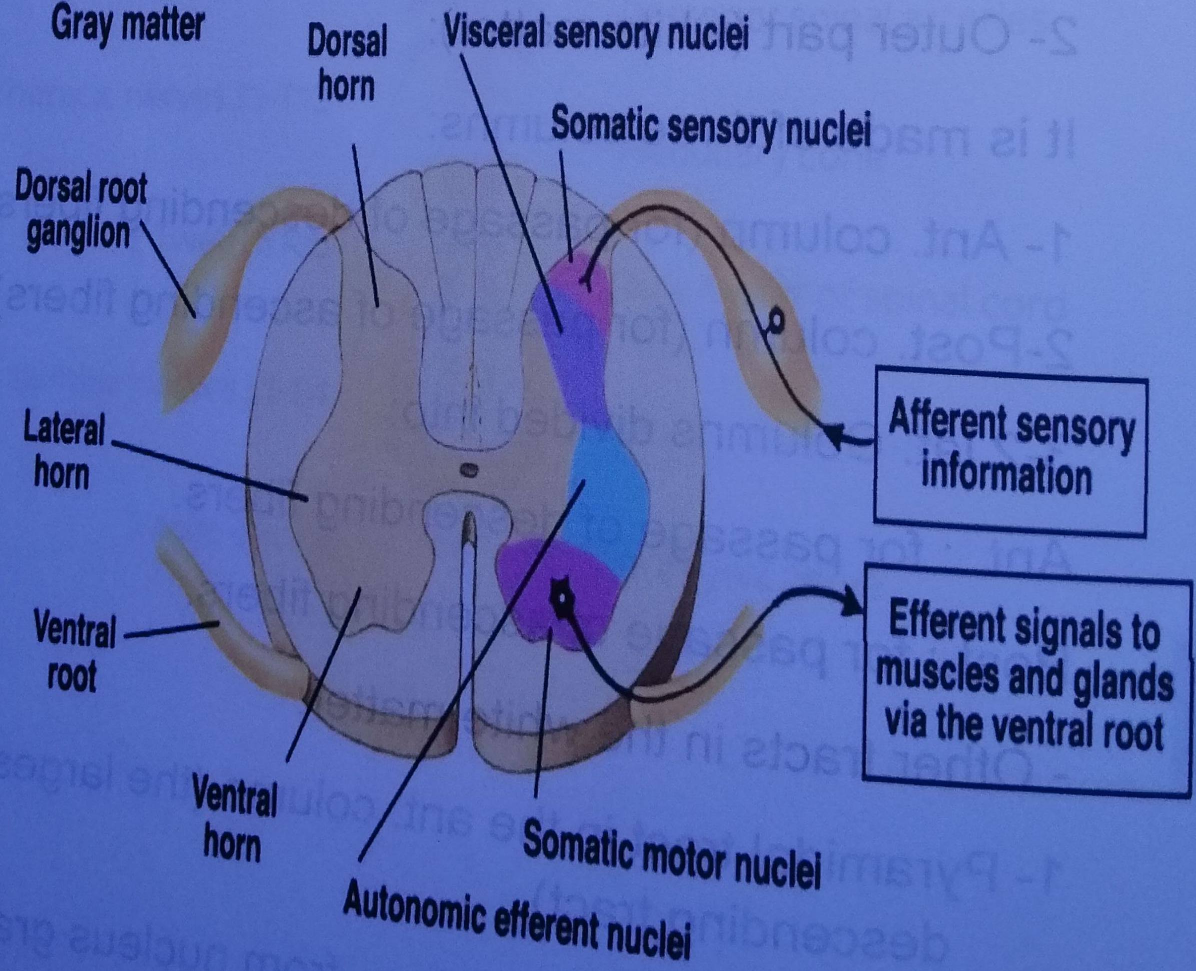
- Other tracts in the white matter:

1- Pyramidal tract in the ant. column (the largest descending tract).

2- Gracilius tract(medially) → from nucleus gracilius

3- Fasciculus tract(laterally) → from nucleus fasciculus


post.
spinal ganglia
Dorsal horn
post. Fissure
Dorsal root
central canal
ventral root
gray matter
ant. Fissure
pyramidal tract
Ant.


Gray matter
Dorsal horn
Visceral sensory nuclei
Somatic sensory nuclei
Dorsal root ganglion
Lateral horn
Afferent sensory information
Ventral root
Efferent signals to muscles and glands via the ventral root
Ventral horn
Somatic motor nuclei
Autonomic efferent nuclei

*Tract: a group of nerve fibers having the same origin, course & termination...

*Bundle(fasciculus): a group of nerve fibers having the different origin, course...

*Ganglion: a group of nerve cells outside the C.N.S in relation with A.N.S.

*Commissure: a band of gray or white matter connecting a part of C.N.S on one side with the corresponding part in the opposite side.

*Leminsci: ribbons.

- Names of the tracts
  - o The name of tract consists of two component : (first term : origin and second term: termination)

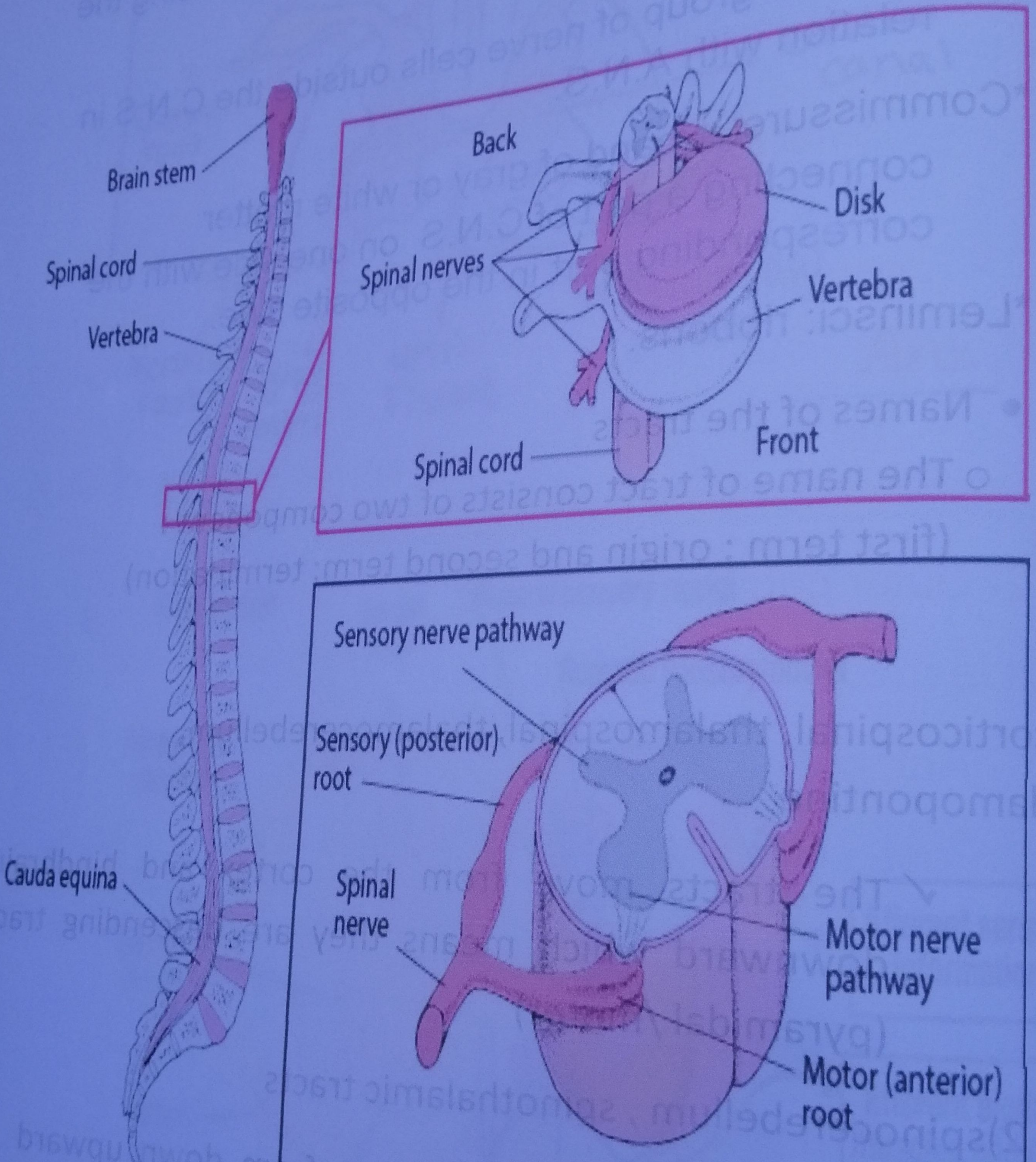
E.g:

1) corticospinal, thalamospinal, thalamocerebellum, thalamopontine

- ✓ The tracts move from the cortex and hindbrain downward which means they are descending tract (pyramidal /motor)

2)spinocerebellum , spinothalamic tracts

- ✓ The previous 2 tracts move from down upward ,so they are ascending (sensory) tracts


Brain stem
Spinal cord
Vertebra
Cauda equina
Back
Disk
Spinal nerves
Vertebra
Spinal cord
Front
Sensory nerve pathway
Sensory (posterior) root
Spinal nerve
Motor nerve pathway
Motor (anterior) root

Spinal Cord Structure

There are 3 types of tracts:

A) Ascending	B) Descending	C) Intersegment
- fasciculus gracilis - fasciculus cuneatus - lateral ,anterior & posterior spinothalamic tracts - anterior& posterior spinocerebellar - spino olivary tract - spinoteactal tract	- lateral & anterior cortiocspinal - rubrospinal tract - vestibulospinal tract - tectospinal tract - olivospinal tract	- dorsolateral fasciculu - septomarginal - comma tract

○ **Clinical Importance:**

1) In the lumber puncture, the needle should be inserted between L3 and L4 to avoid the injury of the spinal cord.
2) Any damage to the spinal cord, the effect will be below the damaged area.
3) Brown-sequard syndrome: is caused by damage to one half (not complete) of the spinal cord, resulting in paralysis and lose of proprioception on the same side" ipsilateral" of injury, but loss of pain and temperature on the opposite side " contralateral" of injury.
4) transverse myelitis is due to complete transverse affection of spinal cord causing paralysis below the level of lesion with loss of all modalities of sensation.
5) spina bifida: a birth defect where there is incomplete closing of the backbones(i.e there is a groove or notch in the vertebrae) that cause the meninges to bulge to outside.

* The defect isn't in the spinal cord itself. Most cases of spina bifida can be prevented if the mother gets enough folate before and during pregnancy.

- Notes:
  - When moving from down upwards, the gray matter becomes larger while the white matter becomes smaller
  - 31 pairs of spinal nerves " peripheral " arise from the spinal cord
  - the most important nerves from the lumbosacral plexus are (.... S2,S3,S4 ➡ " pelvic splanchnic nerves") because they supply the pelvic region. Damage to the pelvic splanchnic nerves causes incontinence " inability to control the evacuative functions of urination or defecation"

Q/ what is the difference between the spinal cord and medulla?

- In the spinal cord : the white matter is laterally while the gray matter is centerally located
- In the medulla : the white matter is centerally while the gray matter is laterally located

Note:

- The shape and size of the gray matter varies according to spinal cord level. At the lower levels, the ratio between gray matter and white matter is greater than in higher levels, mainly because lower levels contain less ascending and descending nerve fibers.
- The cervical and lumber enlargements of the spinal cord result from enlargement of the gray matter.

Brain stem

-components: the brain stem consists of (from above downward)

1- midbrain (continuous with the cerebral hemisphere above)

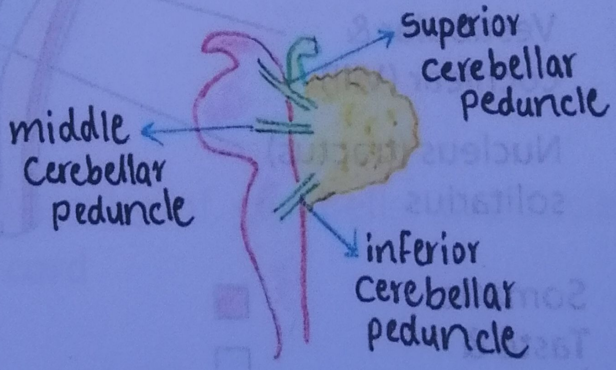
2- pons

3- medulla (continuous with the spinal cord below)

- location: in the posterior cranial fossa

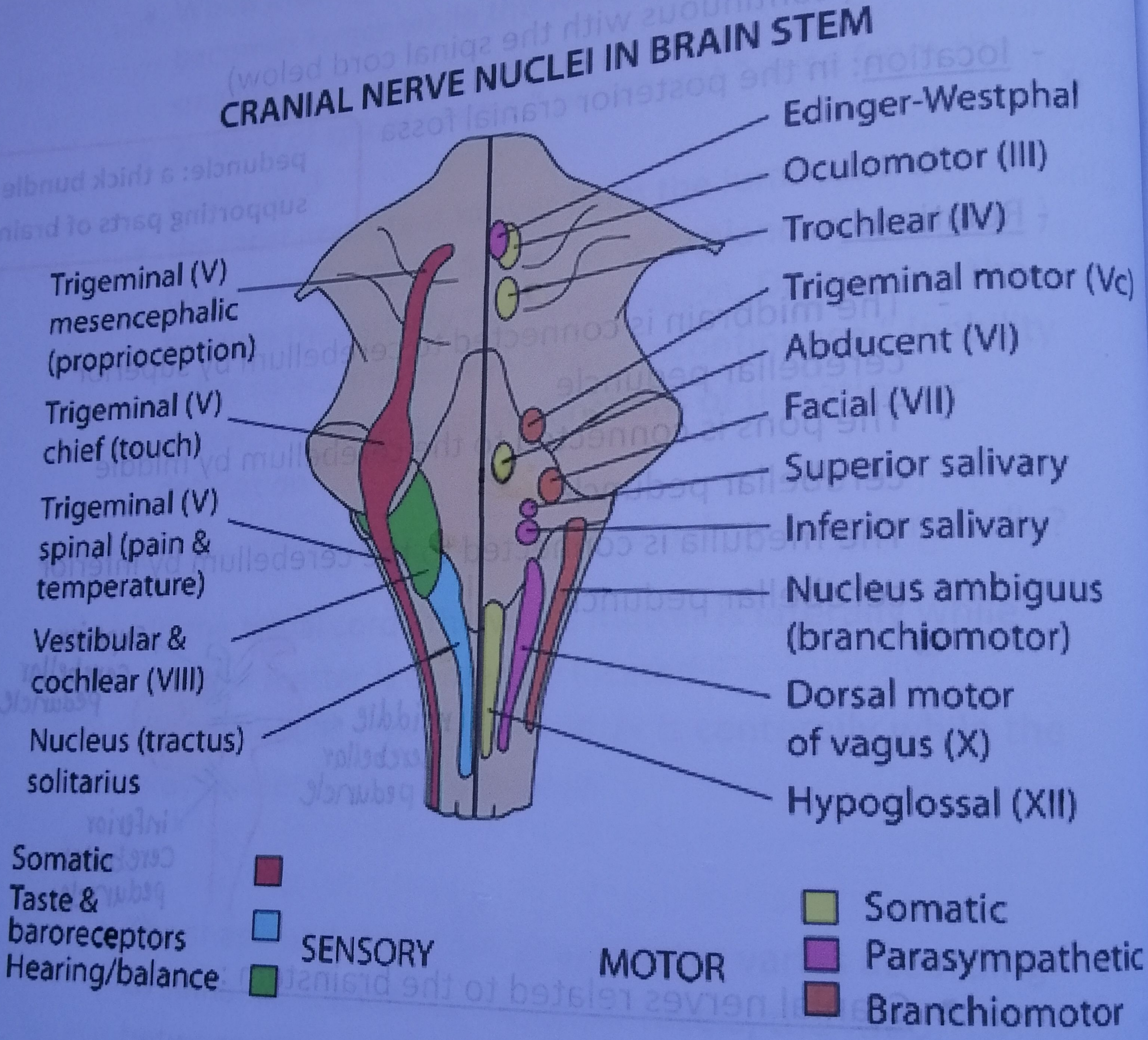
peduncle: a thick bundle supporting parts of brain

- Relations:
  - The midbrain is connected to cerebellum by superior cerebellar peduncle
  - The pons is connected to the cerebellum by middle cerebellar peduncle
  - The medulla is connected to the cerebellum by inferior cerebellar peduncle


Superior cerebellar peduncle
middle Cerebellar peduncle
inferior Cerebellar peduncle

- Cranial nerves related to the brainstem :

- The 3rd and 4th nerves emerges from the surface of the midbrain
- the 5th nerve → from the pons
- The 6th, 7th ,8th nerves emerge at the junction of pons and medulla
- the 9th, 10th ,11th ,12th "nerves emerge from surfaces of medulla."



CRANIAL NERVE NUCLEI IN BRAIN STEM

Edinger-Westphal
Oculomotor (III)
Trochlear (IV)
Trigeminal motor (Vc)
Abducent (VI)
Facial (VII)
Superior salivary
Inferior salivary
Nucleus ambiguus (branchiomotor)
Dorsal motor of vagus (X)
Hypoglossal (XII)
Trigeminal (V) mesencephalic (proprioception)
Trigeminal (V) chief (touch)
Trigeminal (V) spinal (pain & temperature)
Vestibular & cochlear (VIII)
Nucleus (tractus) solitarius
Somatic 🟥
Taste & baroreceptors 🟦
Hearing/balance 🟩
SENSORY
MOTOR
🟨 Somatic
🟪 Parasympathetic
🟧 Branchiomotor

Medulla oblongata

- definition: It's the lowest part of the hind brain.
- surfaces:

it has 2 surfaces: anterior (ventral) and posterior (dorsal)

1- Ventral surface: has 3 sulci:

1) central sulcus → main sulcus which divides the surface into 2 equal halves.

2) 2 anterolateral sulci → divide each half into 2 parts (pyramid and olive).

2- dorsal surface

1) central sulcus.

2) 2 posterolateral sulci.

* The dorsal surface is interrupted by the cavity of the 4th ventricle so the post. central sulcus is at lower level than the ant. central sulcus

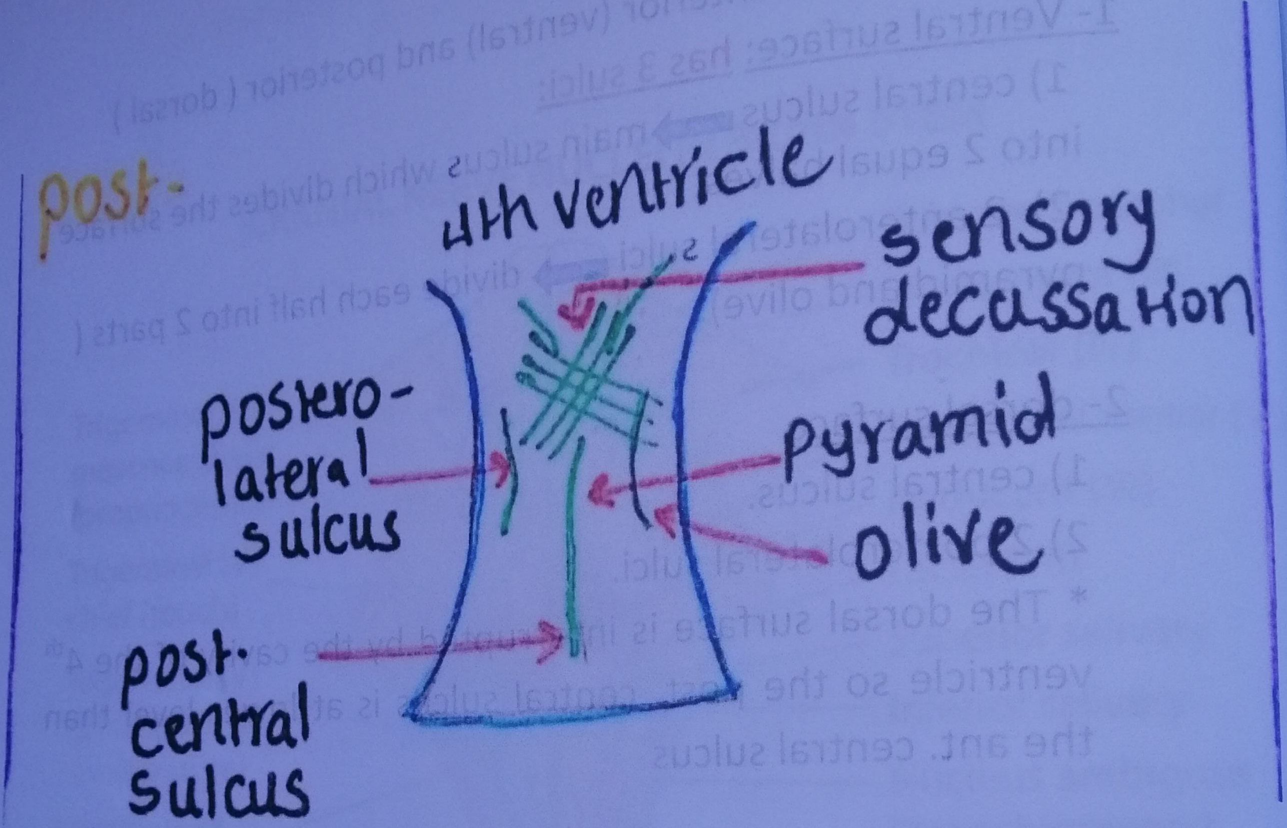
- Relations of medulla:
  - superiorly : related to pons
  - posteriorly : related to cerebellum by inf. cerebellar peduncle
  - inferiorly : continue as spinal cord

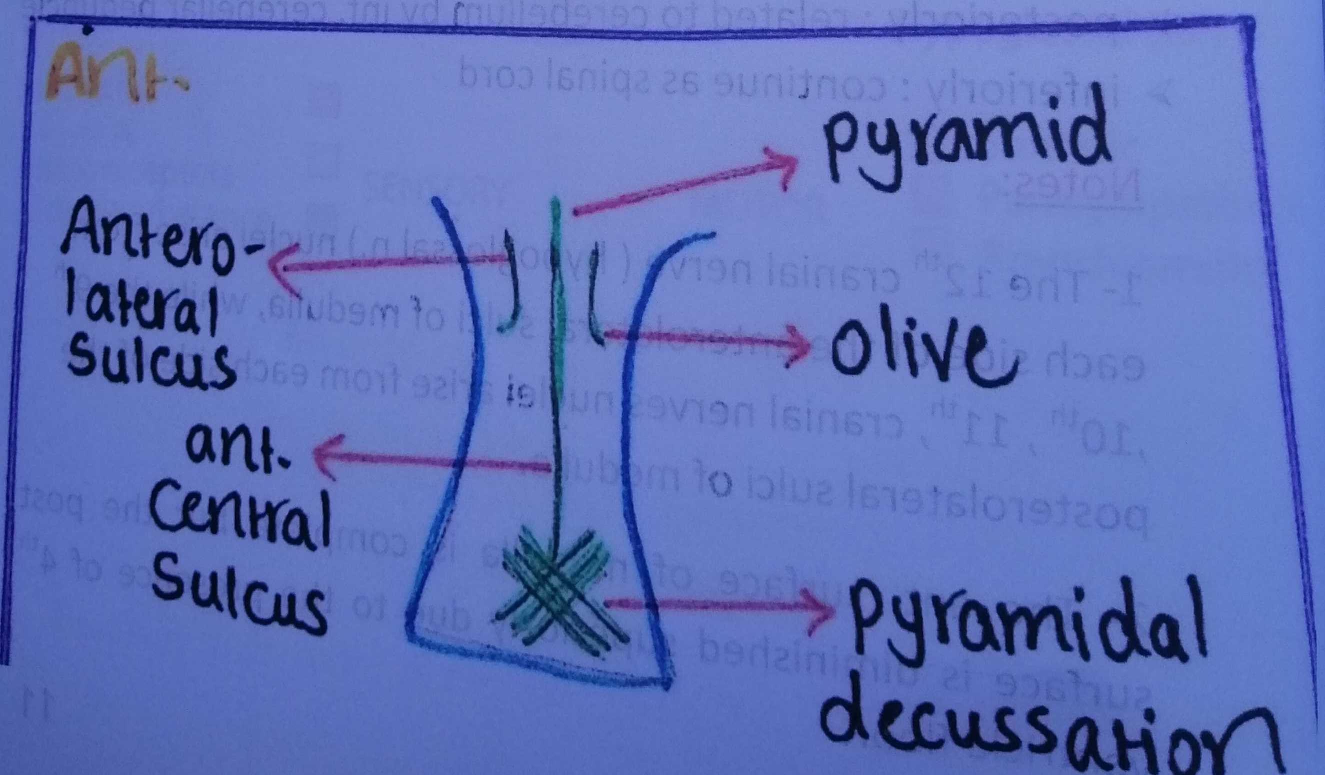
Notes:

1- The 12th cranial nerve (hypoglossal n.) nuclei arise from each side of the anterolateral sulci of medulla, while the 9th ,10th , 11th, cranial nerves nuclei arise from each side of the posterolateral sulci of medulla.

2- The ant. surface of medulla is complete but the post surface is diminished superiorly due to the presence of 4th ventricle floor.

Dorsal and ventral surfaces


post.
4th ventricle
sensory decussation
postero-lateral sulcus
pyramid
olive
post. central sulcus


Ant.
pyramid
Antero-lateral sulcus
olive
ant. Central Sulcus
Pyramidal decussation

3- Pyramids of the ant. Surface of medulla are composed of bundles of nerve fibers of corticospinal tract that descends from cerebral cortex to the spinal cord

4- Between the post. Median sulcus & posterolateral sulcus, the medulla contains ascending tract that enter it from spinal cord:

- Fasciculus gracilis lies medially & end in the nucleus gracilis.
- Fasciculus cuneate lies laterally & ends in the nucleus cuneate.

5-There are decussations in the medulla:

A) Pyramidal decussation:

- At the lower border of medulla.

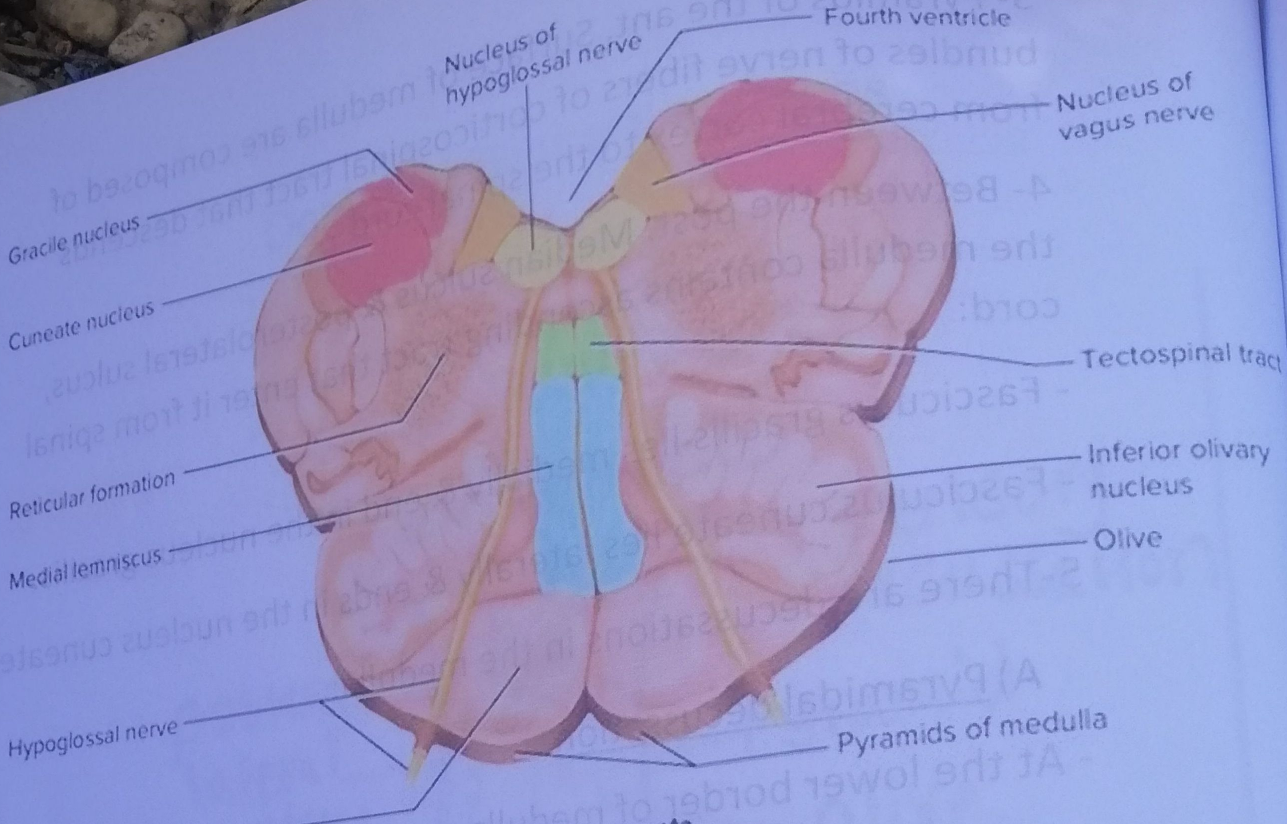
- Descending crossed fibers (motor).

90% of the pyramidal tracts cross from Rt. to lt. & the opposite (clinical point: if the pyramidal tracts of one side are injured bellow the decussation area, the opposite side of the body (motor) will be affected, but if the injury is above the decussation area of fibers, the same side of the body will be affected (Rt & Rt. or lt. & lt.).

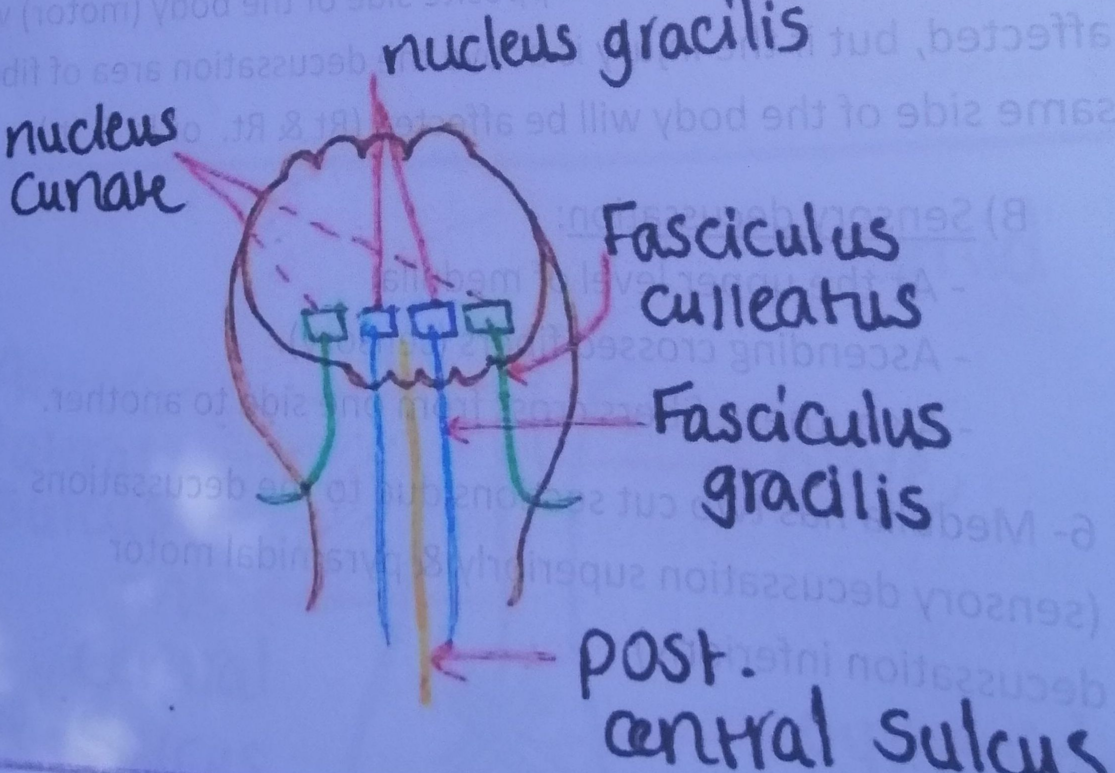
B) Sensory decussation:

- At the upper level of medulla.
- Ascending crossed fibers (sensory).
- Also, these fibers cross from one side to another.

6- Medulla has two cut sections due to the decussations (sensory decussation superiorly & pyramidal motor decussation inferiorly).


Nucleus of hypoglossal nerve
Fourth ventricle
Nucleus of vagus nerve
Gracile nucleus
Cuneate nucleus
Tectospinal tract
Reticular formation
Inferior olivary nucleus
Medial lemniscus
Olive
Hypoglossal nerve
Pyramids of medulla
Corticospinal tract

(c) Medulla oblongata


nucleus gracilis
nucleus cunate
Fasciculus culleatus
Fasciculus gracilis
post. central sulcus

post. view of medulla

- Cavities within the CNS:

1-The cavity of telencephalon (cerebrum) (Lateral ventricle)

2-The cavity of diencephalon (3rd ventricle)

3- The cavity of midbrain (cerebral aqueduct).

4-The cavity of hindbrain (4th ventricle).

#The 4th ventricle: it is related anteriorly to the pons &medulla and Posteriorly to the cerebellum.

Its lower half is formed by the post. surface of the medulla and the upper surface is formed by post. surface of Pons.

- Blood supply of medulla oblongata:

Medullary artery (Branch of vertebral artery).

- Clinical importance:

❖ Medullary syndrome:

- Manifestation of it:

1-Sudden increase in the intracranial pressure.

2-Headache. 3-Vomiting. 4-Nausea.

(Medullary and the brain stem have the same manifestation).

In any brain tumor there are: increase in the intracranial pressure, headache, nausea &vomiting, but if the tumor is in the lower part of the brain (i.e. brain stem) the increase in the intracranial pressure will be sudden not gradual.

Q /How is the increase in intracranial pressure detected?

By using the ophthalmoscope to visualize the retina & optic nerve.

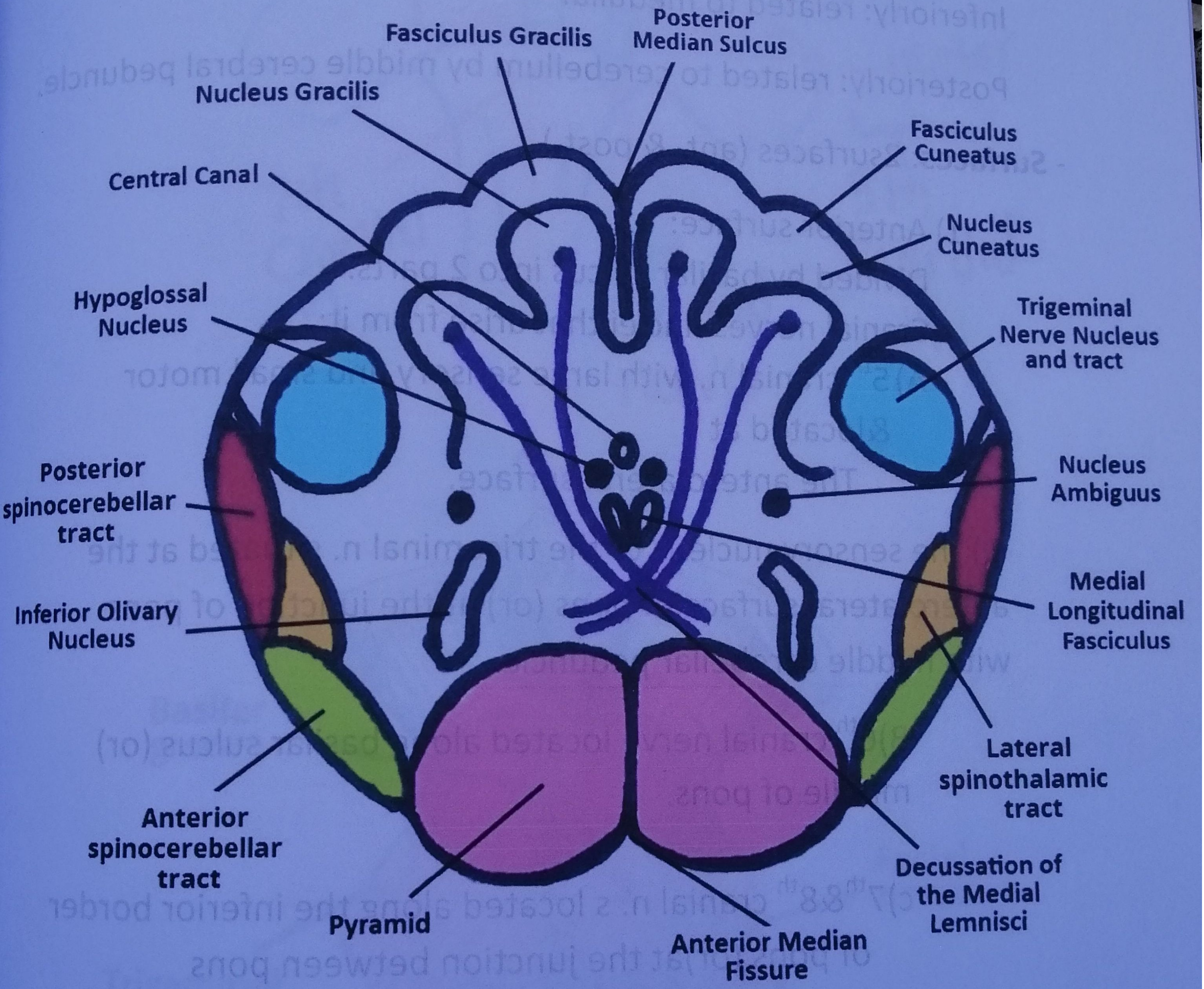
If they seem enlarged that will be indicator of increased intracranial *pressure (papilloedema)*.

- It is also can be detected by CT scan & MRI techniques.

- Before applying the lumber puncture, it is too important to investigate the Intracranial pressure (by ophthalmoscope, CT scan or MRI)Because if there is increase in the intracranial pressure & lumber puncture process is done sudden drop in the intracranial pressure will occur & the brain will shrink down and a part of it may pass through foramina magnum & hernia there this is called coning of medulla oblongata.

*External info:

Level of serum creatinine should be detected before applying CT scan to the kidney and that is because renal failure will be caused if CT scan is done to the kidneys & the serum creatinine is high.


Fasciculus Gracilis
Posterior Median Sulcus
Nucleus Gracilis
Fasciculus Cuneatus
Central Canal
Nucleus Cuneatus
Hypoglossal Nucleus
Trigeminal Nerve Nucleus and tract
Posterior spinocerebellar tract
Nucleus Ambiguus
Medial Longitudinal Fasciculus
Inferior Olivary Nucleus
Lateral spinothalamic tract
Anterior spinocerebellar tract
Decussation of the Medial Lemnisci
Pyramid
Anterior Median Fissure

Pons

(means arch and it is arch in shape)

- **Definition**: it is the middle part of the brain stem.

- **Relations**: superiorly: related to midbrain.

Inferiorly: related to medulla.

Posteriorly: related to cerebellum by middle cerebral peduncle.

- **Surfaces**: 2surfaces (ant. & post.).

1) Anterior surface:

Divided by basilar sulcus into 2 parts.

Cranial nerves nuclei that arise from it:

A) 5th cranial n. with large sensory and small motor &located at

The anterolateral surface.

Q) the sensory nucleus of the trigeminal n. situated at the anterolateral surface of pons (or) at the junction of pons with middle cerebellar peduncle.

B)6th cranial nerve located along basilar sulcus (or) middle of pons.

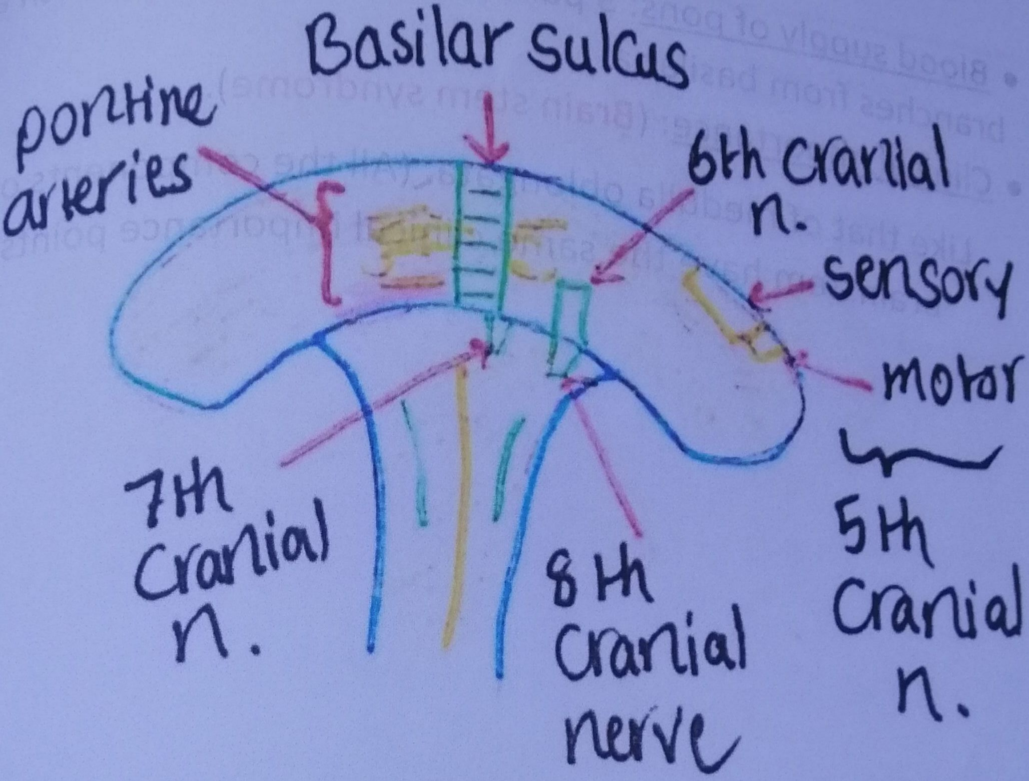
c)7th&8th cranial n. s located along the inferior border of pons (or)at the junction between pons &medulla.

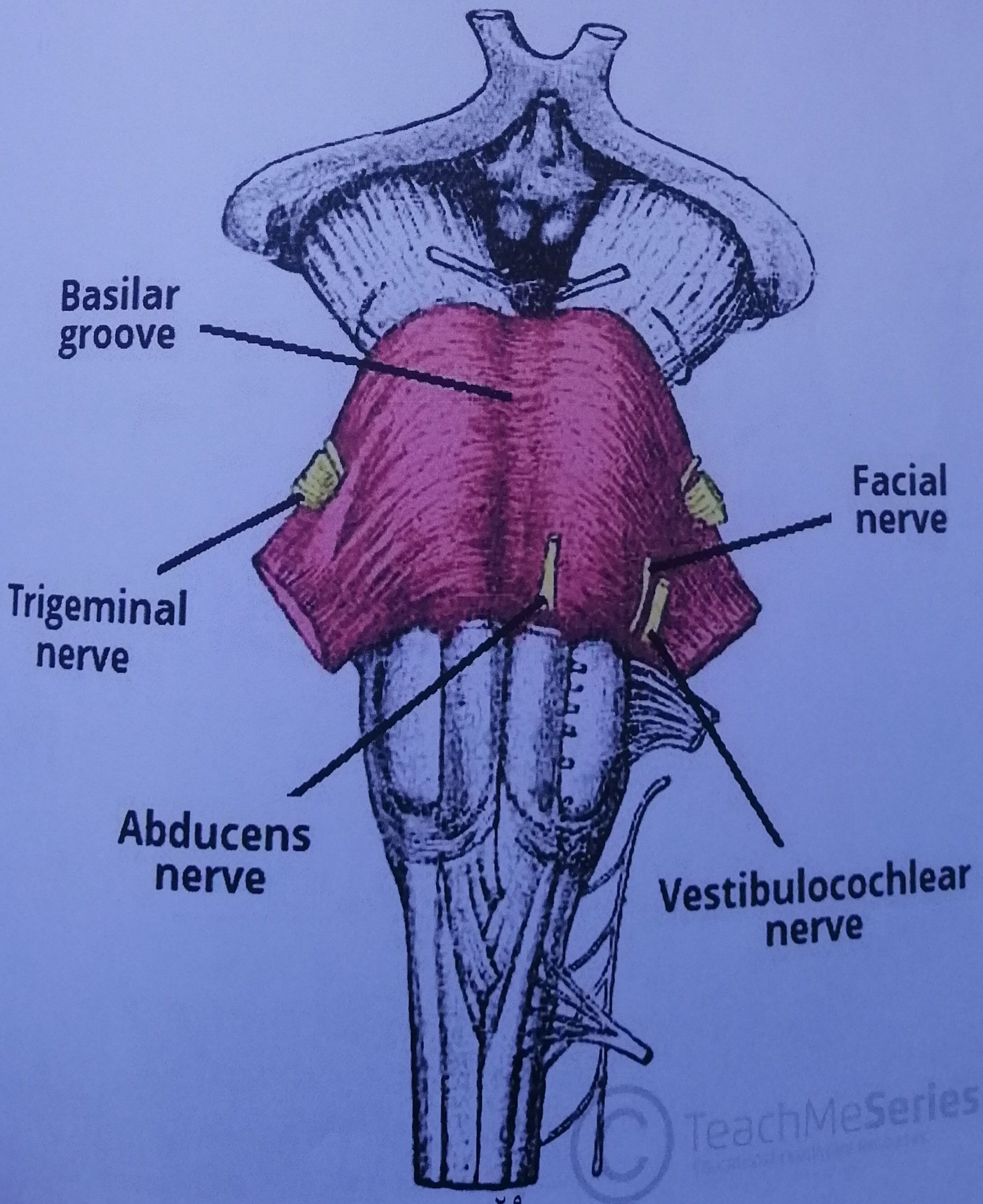
Note:

Basilar sulcus is called by the name because the basilar artery lines it forming a groove (sulcus).

2)Posterior surface:

Forms the upper half of the 4th ventricle.

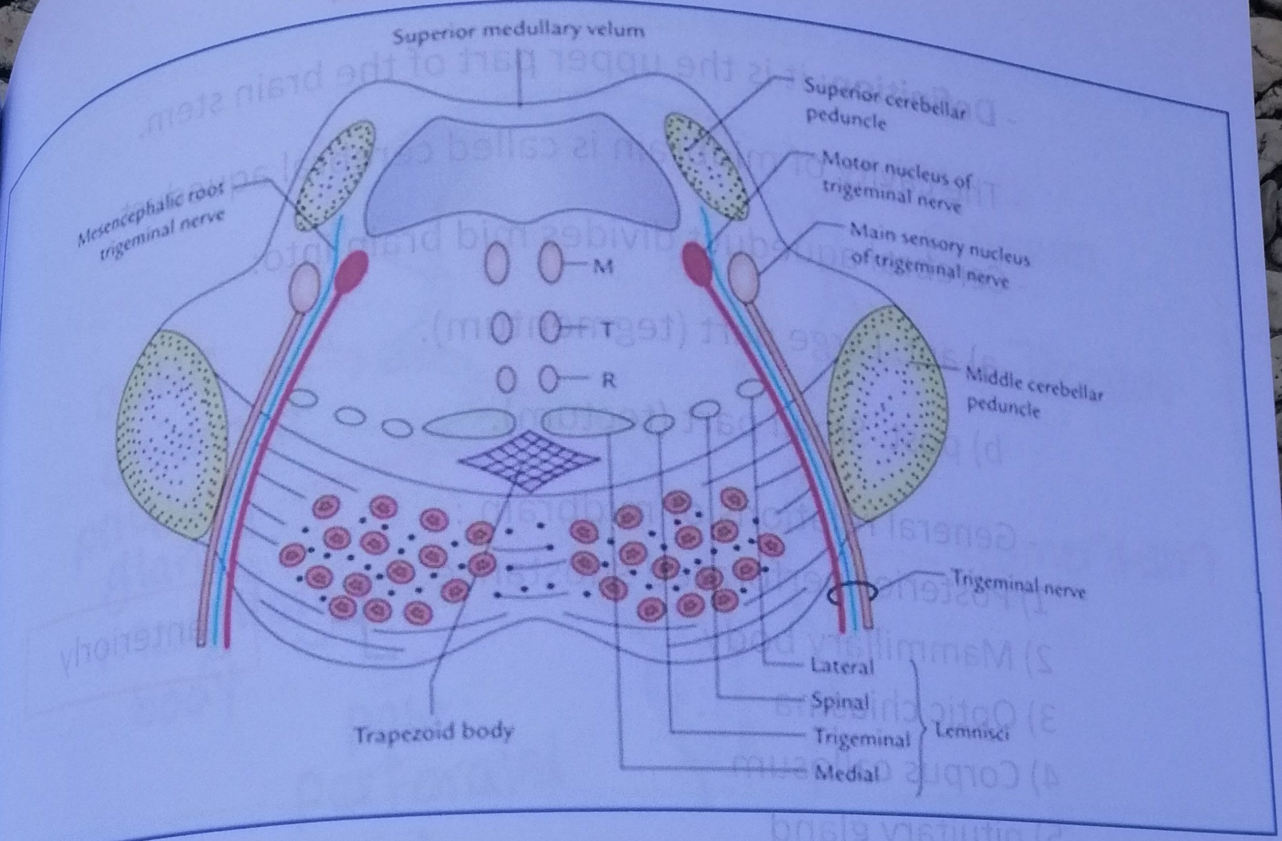

Basilar Sulcus
pontine arteries
6th Cranial n.
sensory
motor
5th Cranial n.
7th Cranial n.
8th Cranial nerve

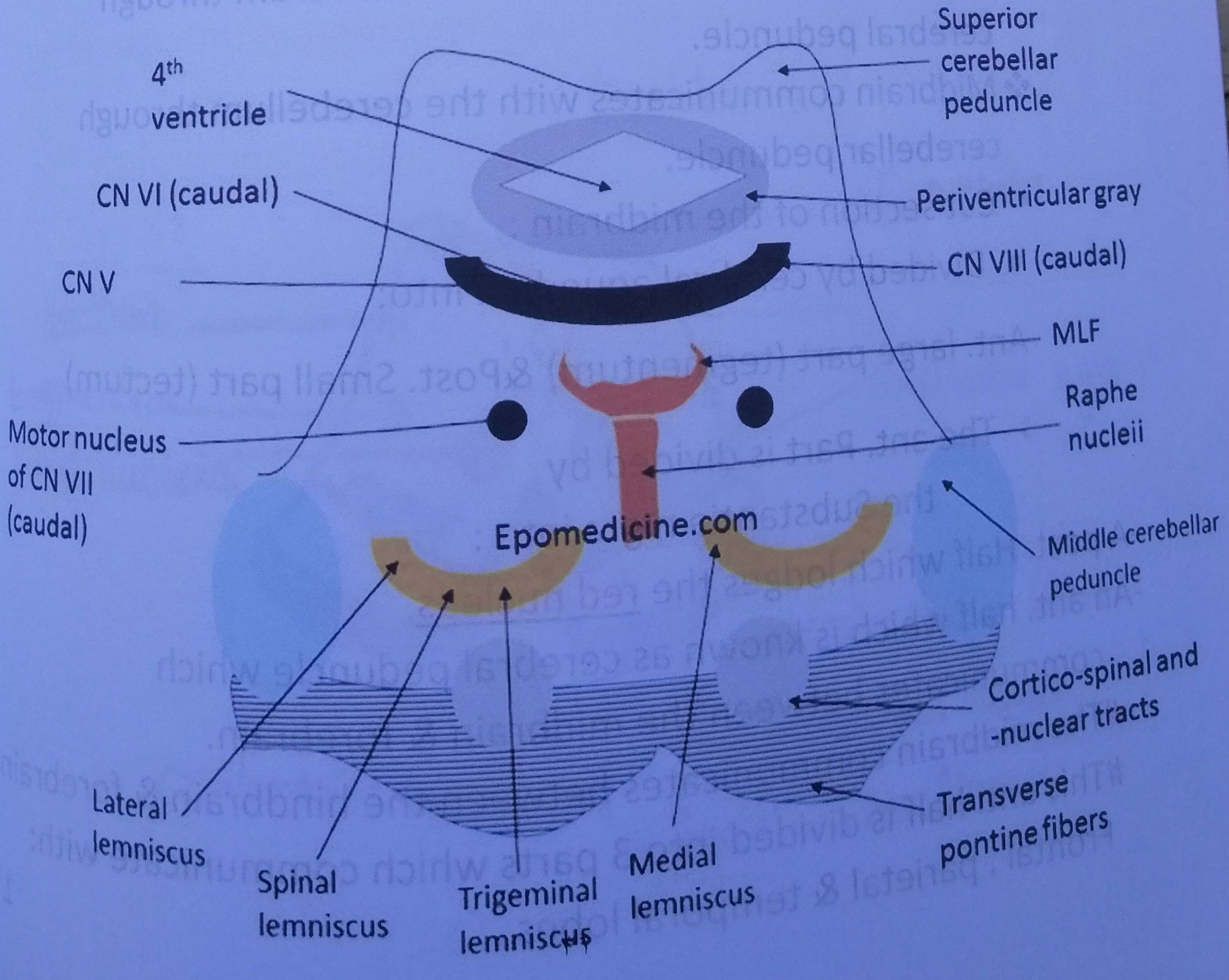

Basilar groove
Facial nerve
Trigeminal nerve
Abducens nerve
Vestibulocochlear nerve

© TeachMeSeries

- Blood supply of pons: 3 pairs of pontine arteries which are branches from basilar a.
- Clinical importance: (Brain stem syndrome).

Like that of medulla oblongata. (All the components of the brainstem have the same clinical importance points).


Superior medullary velum
Superior cerebellar peduncle
Mesencephalic root trigeminal nerve
Motor nucleus of trigeminal nerve
Main sensory nucleus of trigeminal nerve
M
T
R
Middle cerebellar peduncle
Trigeminal nerve
Trapezoid body
Lateral
Spinal
Trigeminal
Medial
Lemnisci


4th ventricle
Superior cerebellar peduncle
CN VI (caudal)
Periventricular gray
CN V
CN VIII (caudal)
MLF
Raphe nucleii
Motor nucleus of CN VII (caudal)
Epomedicine.com
Middle cerebellar peduncle
Cortico-spinal and -nuclear tracts
Transverse pontine fibers
Lateral lemniscus
Spinal lemniscus
Trigeminal lemniscus
Medial lemniscus

Midbrain

- **Definition**: it is the upper part of the brain stem.

- The cavity of midbrain is called cerebral aqueduct.

- Cerebral aqueduct divides mid brain into:

a) ant. Large part (tegmentum).

b) post. Small part (tectum).

- General relations of midbrain :

1) Posterior perforated substance } anteriorly
2) Mammillary body
3) Optic chiasma
4) Corpus callosum
5) pituitary gland
6) thalamus & hypothalamus(diencephalon) } superiorly
7) Pons } inferiorly

❖ Midbrain communicates with the cerebrum through cerebral peduncle.

❖ Midbrain communicates with the cerebellum through cerebellar peduncle.

- Cut section of the midbrain :
- Divided by cerebral aqueduct into:

Ant. large part (tegmentum) &Post. Small part (tectum)

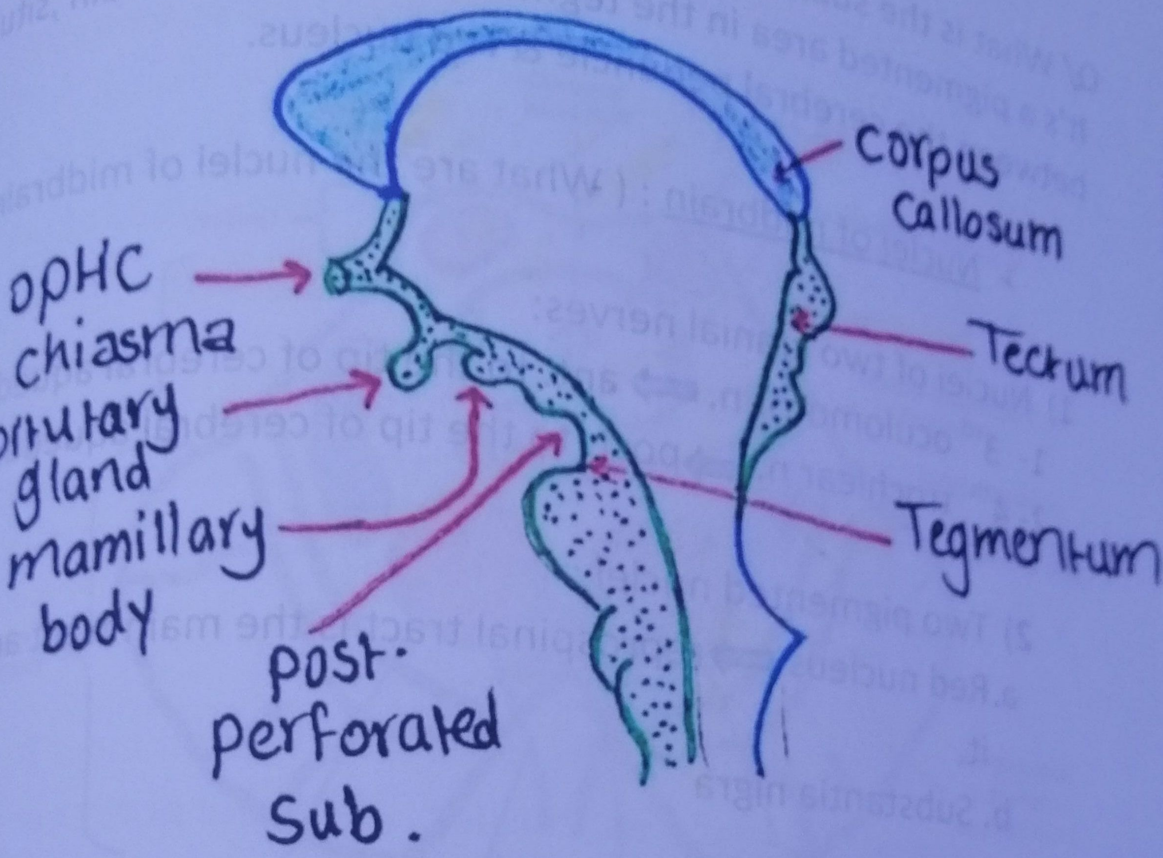
➢ The ant. Part is divided by the Substantia nigra into :

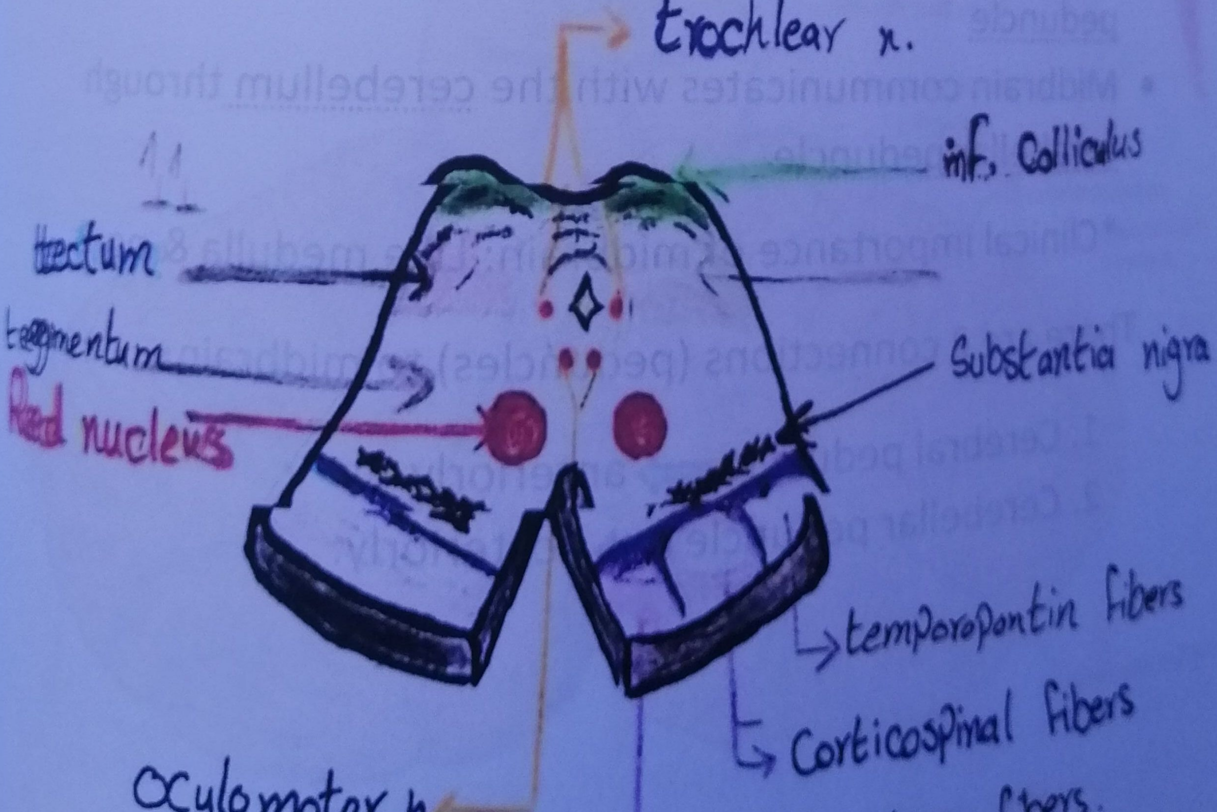
-A post. Half which lodges the red nucleus

-An ant. half which is known as cerebral peduncle which communicates between the midbrain & forebrain.

#The midbrain communicates between the hindbrain & forebrain.

#This ant. half is divided into 3 parts which communicate with: Frontal , parietal & temporal lobes .


Corpus Callosum
optic chiasma
Tectum
pitutary gland
mamillary body
Tegmentum
post. perforated sub.


trochlear n.
inf. Colliculus
tectum
tegmentum
Red nucleus
Substantia nigra
temporopontin fibers
Corticospinal fibers
Oculomotor n.
Frontopontine fibers.

Q/ What is the substantia nigra ?

It's a pigmented area in the tegmentum of the midbrain ,situated between the cerebral peduncle & red nucleus.

➢ Nuclei of midbrain : (What are the nuclei of midbrain ?)

1) Nuclei of two cranial nerves:

1- 3rd oculomotor n. ➡ ant. to the tip of cerebral aqueduct.

2- 4th trochlear n. ➡ post. to the tip of cerebral aqueduct.

2) Two pigmented nuclei :

a. Red nucleus ➡ reprospinal tract is the main tract arising from it.

b. Substantia nigra

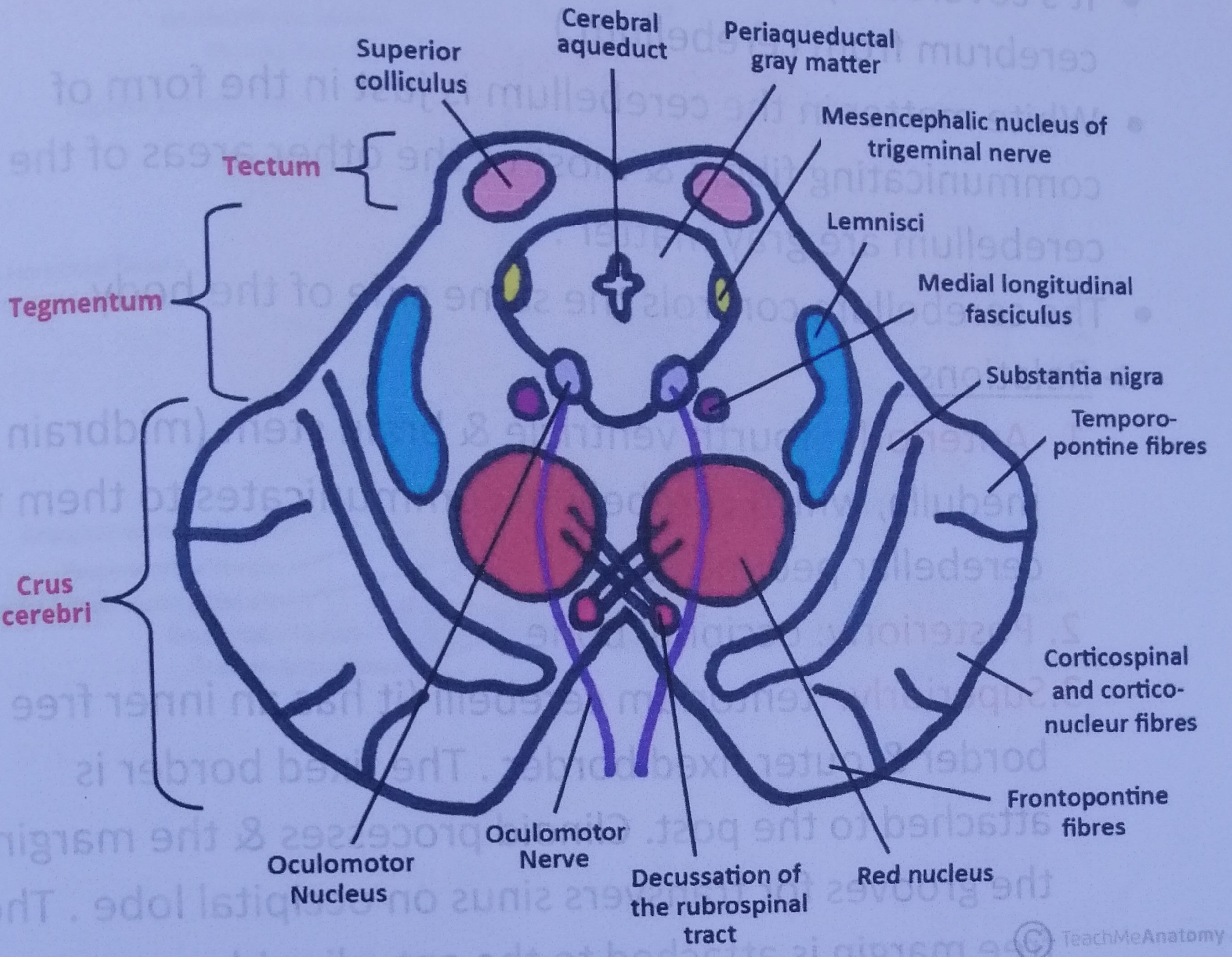
Note:

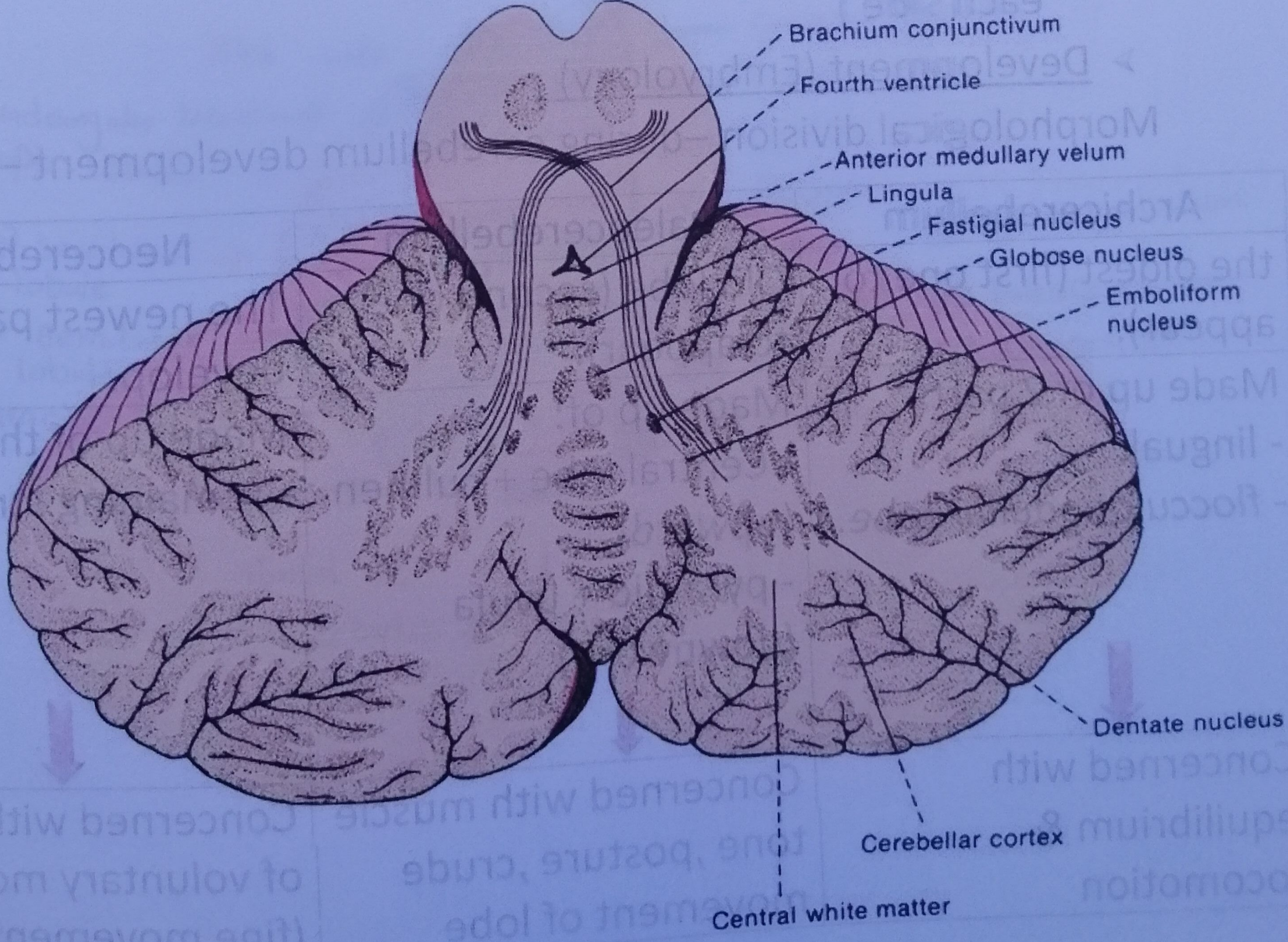
- All the nuclei of midbrain are situated in the tegmentum
- The main tract in midbrain is the reprospinal tract
- Midbrain communicates with the cerebrum through cerebral peduncle
- Midbrain communicates with the cerebellum through cerebellar peduncle

*Clinical importance of midbrain: Like medulla & pons.

There are 2 connections (peduncles) to midbrain :

1. Cerebral peduncle ➡ anteriorly.
2. Cerebellar peduncle ➡ posteriorly.


Cerebral aqueduct
Superior colliculus
Periaqueductal gray matter
Mesencephalic nucleus of trigeminal nerve
Tectum
Lemnisci
Tegmentum
Medial longitudinal fasciculus
Substantia nigra
Temporo-pontine fibres
Crus cerebri
Corticospinal and cortico-nucleur fibres
Frontopontine fibres
Oculomotor Nerve
Oculomotor Nucleus
Decussation of the rubrospinal tract
Red nucleus
TeachMeAnatomy


Brachium conjunctivum
Fourth ventricle
Anterior medullary velum
Lingula
Fastigial nucleus
Globose nucleus
Emboliform nucleus
Dentate nucleus
Cerebellar cortex
Central white matter

The cerebellum

- It's the largest posterior part of the hindbrain
- It's covered by tentorium cerebelli (which separates the cerebrum from cerebellum)
- White matter in the cerebellum is just in the form of communicating fibers & most of the other areas of the cerebellum are gray matter .
- The cerebellum controls the same side of the body.

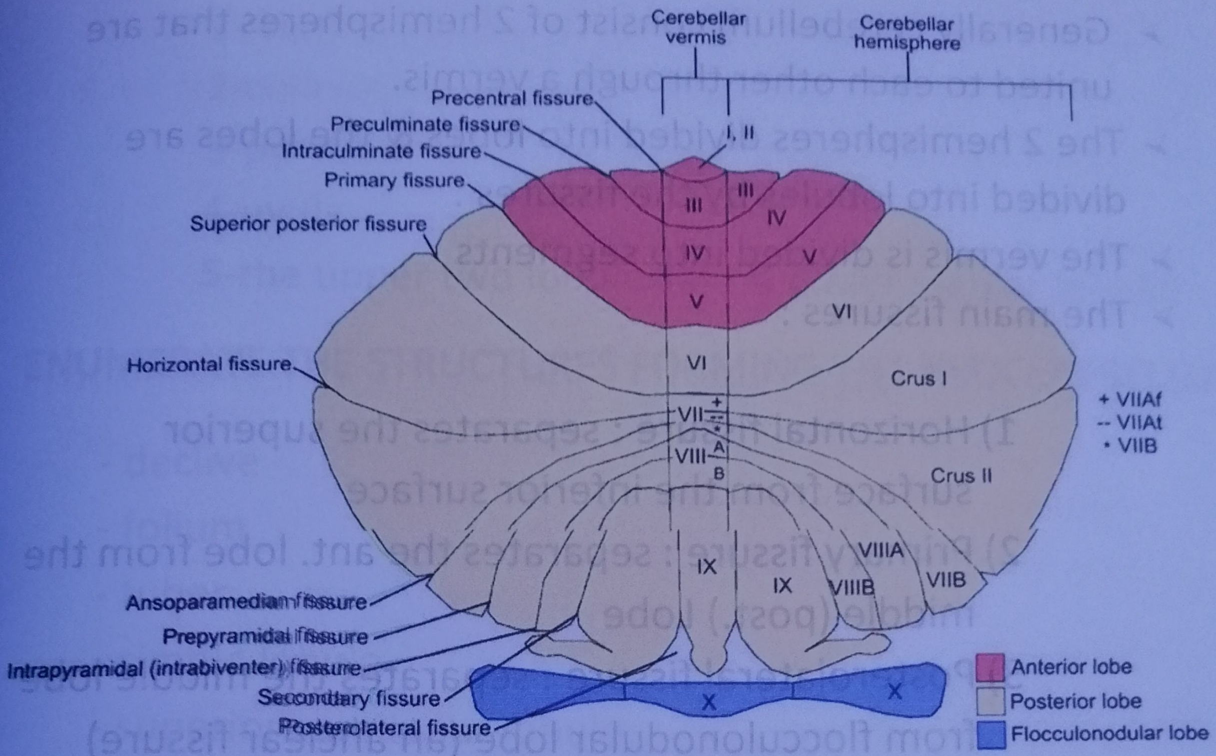
➢ Relations :

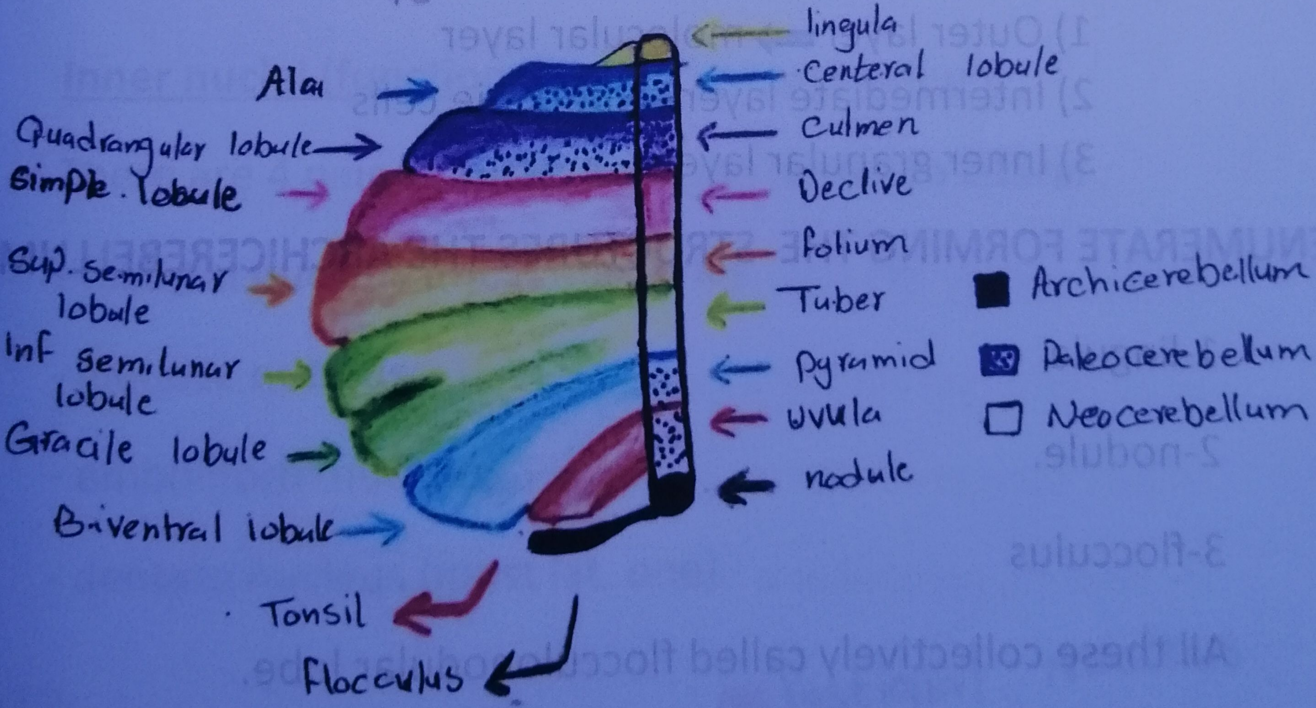
1. Anteriorly: fourth ventricle & brain stem (midbrain , pons , medulla, which cerebellum communicates to them through cerebellar peduncles)
2. Posteriorly: occipital bone
3. Superiorly: tentorium cerebelli (it has an inner free border & outer fixed border . The fixed border is attached to the post. Clinoid processes & the margins of the grooves for transvers sinus on occipital lobe . The free margin is attached to the ant. clinoid process on each side)

➢ Development (Embryology) :

Morphological division –during cerebellum development – into:

Archicerebellum	Paleocerebellum	Neocerebellum
the oldest (first one to appear).	Old lobe (second one to appear).	The newest part to develop.
Made up of 2 parts - lingual. - flocculonodullar lobe. ↓	Made up of: - Central lobe + culmen (upward) - pyramid + uvula (downward) ↓	Made up of the - remaining structures ↓
Concerned with equilibrium & locomotion	Concerned with muscle tone ,posture ,crude movement of lobe	Concerned with control of voluntary movement (fine movements)


Cerebellar vermis
Cerebellar hemisphere
Precentral fissure
Preculminate fissure
Intraculminate fissure
Primary fissure
Superior posterior fissure
Horizontal fissure
Ansoparamedian fissure
Prepyramidal fissure
Intrapyramidal (intrabiventer) fissure
Secondary fissure
Posterolateral fissure
I, II
III
IV
V
VI
VII
VIII
A
B
IX
X
Crus I
Crus II
VIIIA
VIIIB
VIIB
+ VIIAf
-- VIIAt
• VIIB
Anterior lobe
Posterior lobe
Flocculonodular lobe


lingula
Centeral lobule
Culmen
Declive
folium
Tuber
pyramid
uvula
nodule
Ala
Quadrangular lobule
Simple lobule
Sup. semilunar lobule
Inf semilunar lobule
Gracile lobule
Biventral lobule
Tonsil
Flocculus
Archicerebellum
Paleocerebellum
Neocerebellum

- Generally cerebellum consist of 2 hemispheres that are united to each other through a vermis.
- The 2 hemispheres divided into lobes & the lobes are divided into lobules by the fissures .
- The vermis is divided into segments
- The main fissures :

  1) Horizontal fissure : separates the superior surface from the inferior surface
  2) Primary fissure : separates the ant. lobe from the middle (post.) Lobe
  3) Posterolateral fissure : separates the middle lobe from flocculonodular lobe (an anclear fissure)
- The primary & posterolateral (secondary) fissures are from the content of the neocerebellum .
- Histological structure of cerebellum :

  Made of 3 layers :
  1) Outer layer ➡ molecular layer
  2) Intermediate layer ➡ purkinje cells
  3) Inner granular layer

ENUMERATE FORMING THE STRUCTURES THE ARCHICEREBELLUM :

1-lingula

2-nodule.

3-flocculus

All these collectively called flocculonodular lobe.

ENUMERATE THE STRUCTURES FORMING THE PALEOCEREBELLUM :

1- central lobule.
2-culmen.
3-pyramid
4-uvula
5-the upper two lobules(ala & quadrangular lobule)

ENUMERATE THE STRUCTURES FORMING THE NEOCEREBELLUM :

- declive
- folium
- tuber
- simple lobule
- superior semilunar lobule
- inferior semilunar lobule
- gracile lobule
- biventral lobule
- tonsil

Inner nuclei (functional nuclei) of cerebellum :

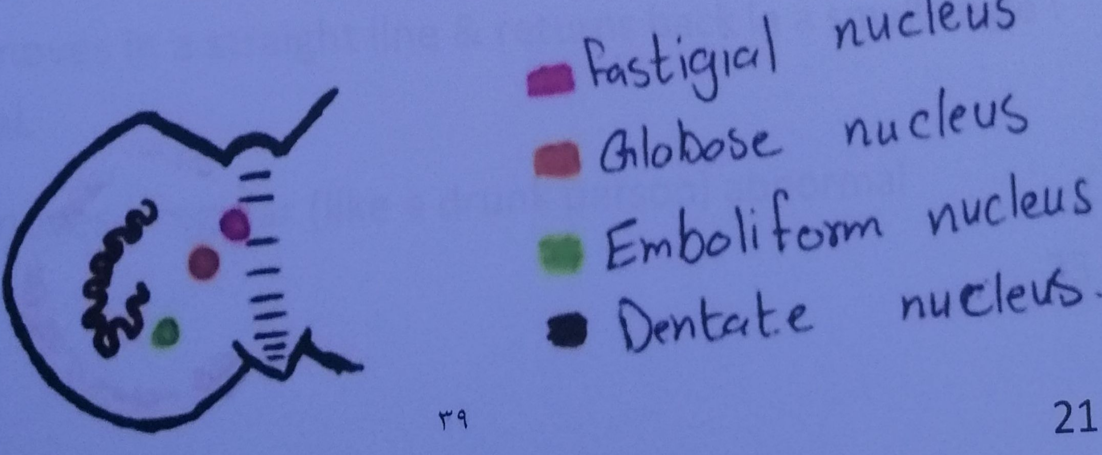
There are 4 pair of nuclei from the center to lateral :

- fastigial nucleus (most med.one)

- globose nucleus

- emboliform nucleus

- dentate nucleus (most lat. one)


🟪 Fastigial nucleus
🟥 Globose nucleus
🟩 Emboliform nucleus
● Dentate nucleus.

Functions of the nuclei :

-the cerebellum gives rise to the afferent &efferent tract which connect the cerebellum with the cerebrum ,the nuclei of the brain steam & spinal cord .

There are 3 cerebellar peduncles which form a pathway for the afferent & efferent tracts.

Cerebellar peduncles	tracts
1-superior cerebellar peduncle connect the cerebellum to midbrain.	e.g: cerebello-rubral tract
2-middle cerebellar peduncle connect cerebellum to pons.	e.g: pontocerebellar fibers .
3-inferior cerebellar peduncle connects the cerebellum to medulla &spinal cord	e.g: post.spinocerebellar tract

Blood supply of cerebellum:

1- superior cerebellar a. ➡ branch from basilar a.

2- ant. inf. cerebellar a. ➡ branch from basilar a.

3- post.inf. cerebellar a. ➡ branch from vertebral a.

Functions of cerebellum:

1- coordinate voluntary movements.

2- control tone.

3- control of posture & equilibrium.

4- control stretch reflex.

Applied anatomy :

Cerebellar syndrome

Symptoms include :

(Headache ,dizziness, vomiting ,increase in intracranial pressure , impaired coordination &equilibrium ,repetitive eye movements (nystagmus).

Some ways of cerebellum investigation:

1-finger-nose test:

Ask the patient to direct his finger to the tip of his nose several times in fast movements.

If he can :normal if not so, there is a problem in his cerebellum.

2-walking gait :

Ask the patient to walk in a straight line &the ask him to return back to the point he began from.

If he moves in a straight line & returns back in a small angle : normal.

If he moves irregular (like a drunk person) abnormal

Medullary (brain stem) syndrome : sudden increase in ICP while cerebellar syndrome :gradual increase in ICP.

Cerebellar syndrome comprises of:	Medullary syndrome comprises of:
1- Ataxia 2-Positive rhomberg sign 3- Nystagmus 4-Intention tremors 5-Dysmetria 6-Rebound	1- Horner syndrome 2- cerebellar signs 3- affection of cranial n. 5th ,7th ,9th ,10th.

Thalamus

- **Definition**: *the relay station of all sensory (ascending) tract except smell (all the sensation pass through the thalamus then to the cerebral cortex except the smell sensation which passes directly to cerebral cortex without passing through thalamus)*

New researches say that smell passes through the thalamus

- **Relation:**
  - Anteriorly (or medially) ➡ hypothalamus
  - Posteriorly (or laterally) ➡ internal capsule
- Thalamic nuclei :

1-anterior group

2-medial group

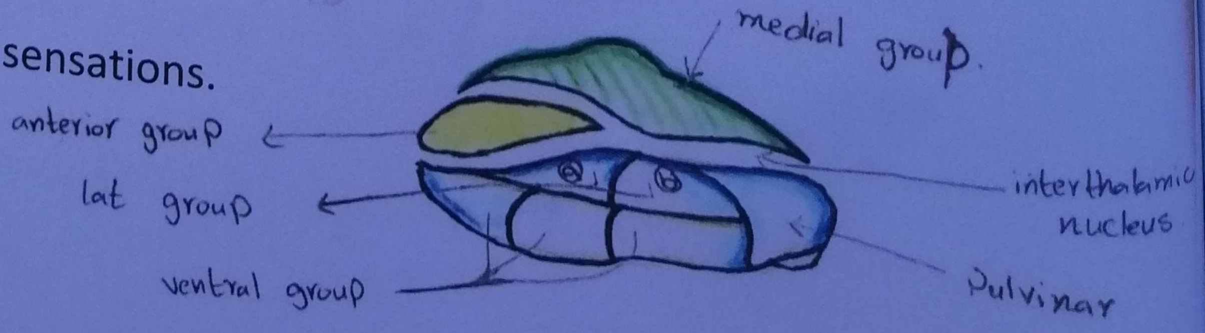
3-lateral group → a-dorsolateral nuclei
→ b- posterolateral nuclei

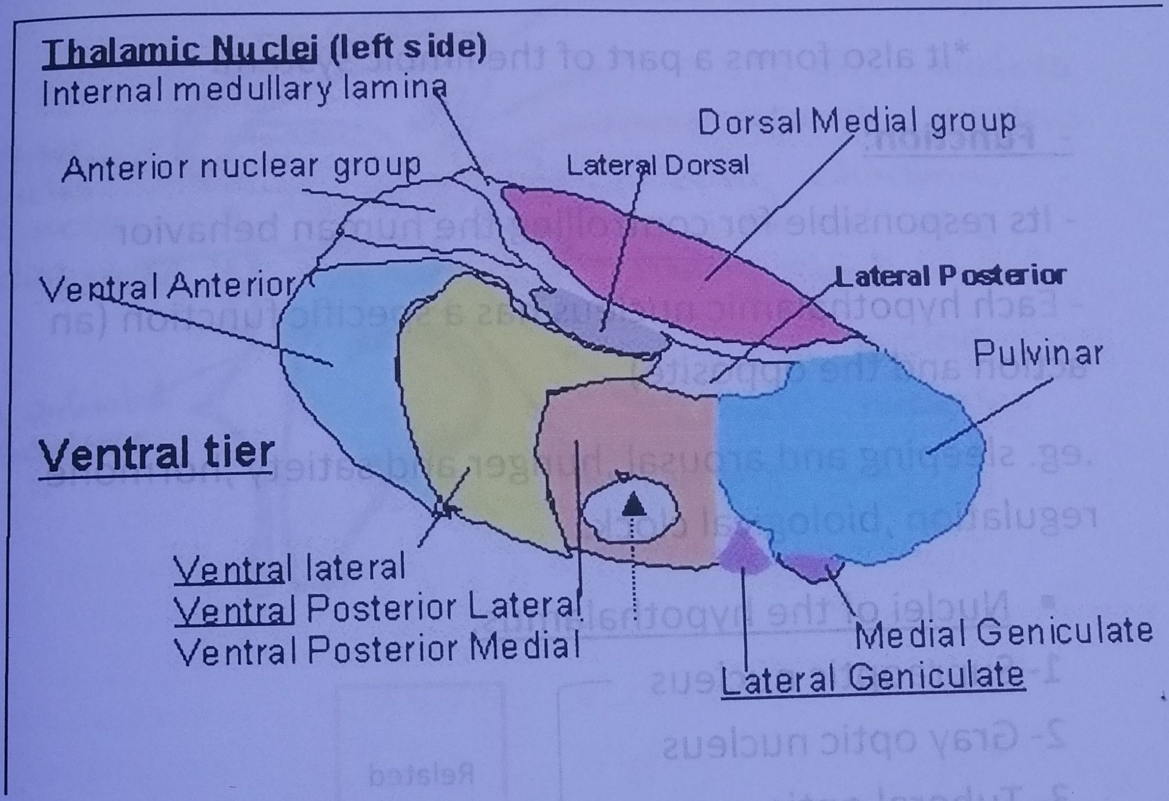
4-ventral group

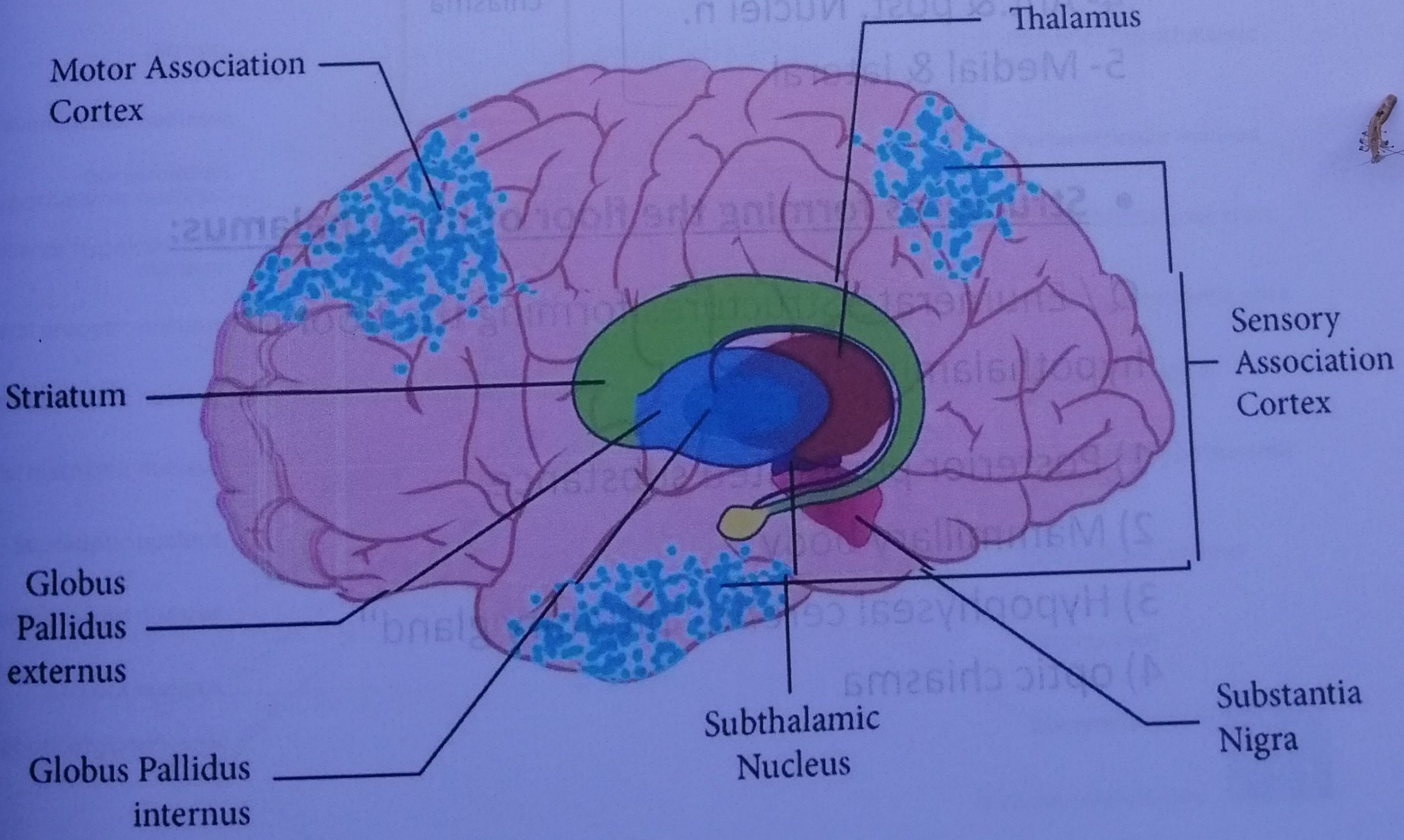
5-non specific nuclei → a- intralaminar n.
→ b- reticular n.
→ c- middle line

Clinical thalamus:

Loss of sensations.


medial group.
anterior group
lat group
ventral group
interthalamic nucleus
Pulvinar


Thalamic Nuclei (left side)
Internal medullary lamina
Anterior nuclear group
Lateral Dorsal
Dorsal Medial group
Ventral Anterior
Lateral Posterior
Pulvinar
Ventral tier
Ventral lateral
Ventral Posterior Lateral
Ventral Posterior Medial
Medial Geniculate
Lateral Geniculate


Motor Association Cortex
Thalamus
Sensory Association Cortex
Striatum
Globus Pallidus externus
Globus Pallidus internus
Subthalamic Nucleus
Substantia Nigra

Hypothalamus

- **Definition**: it's the chief organ of the autonomic nervous system

*It also forms a part of the limbic system.

- **Function:**

- Its responsible for controlling the human behavior

- Each hypothalamic nucleus has a specific function (an action and the opposite)

.eg. sleeping and arousal ,hunger and satiety ,hormone regulation ,biological clock.

- Nuclei of the hypothalamus:

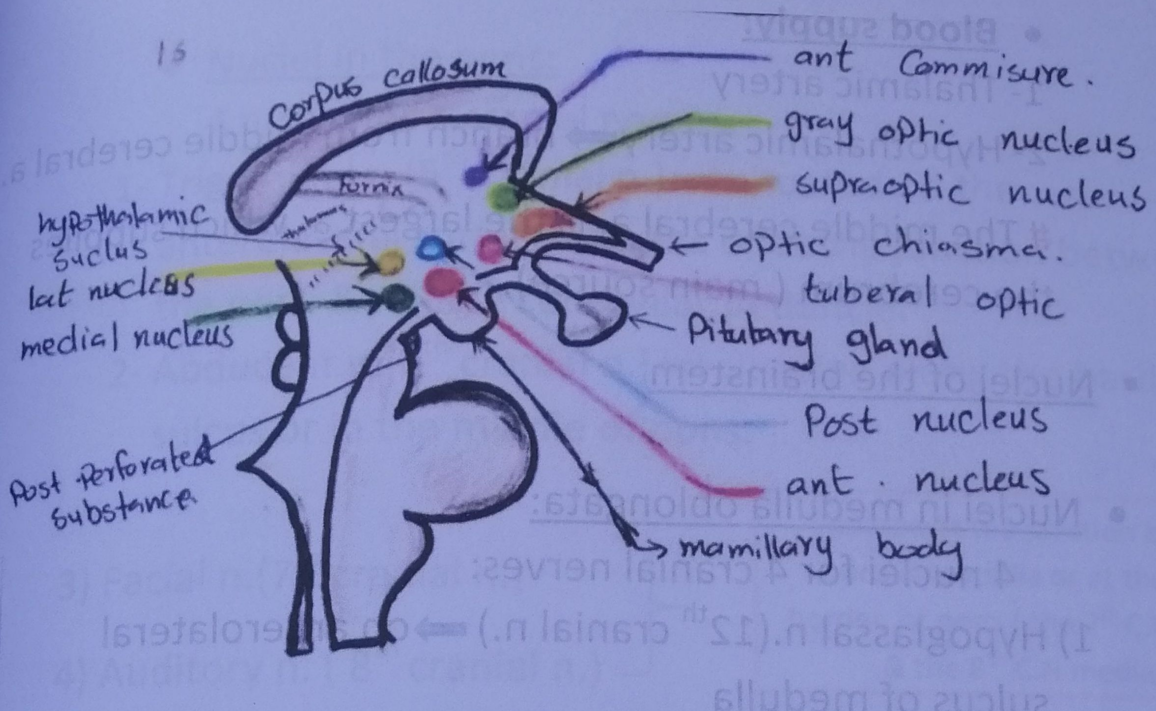
1- Supraoptic nucleus
2- Gray optic nucleus
3- Tuberal optic
4- Ant.& post. Nuclei n.
5- Medial & lateral

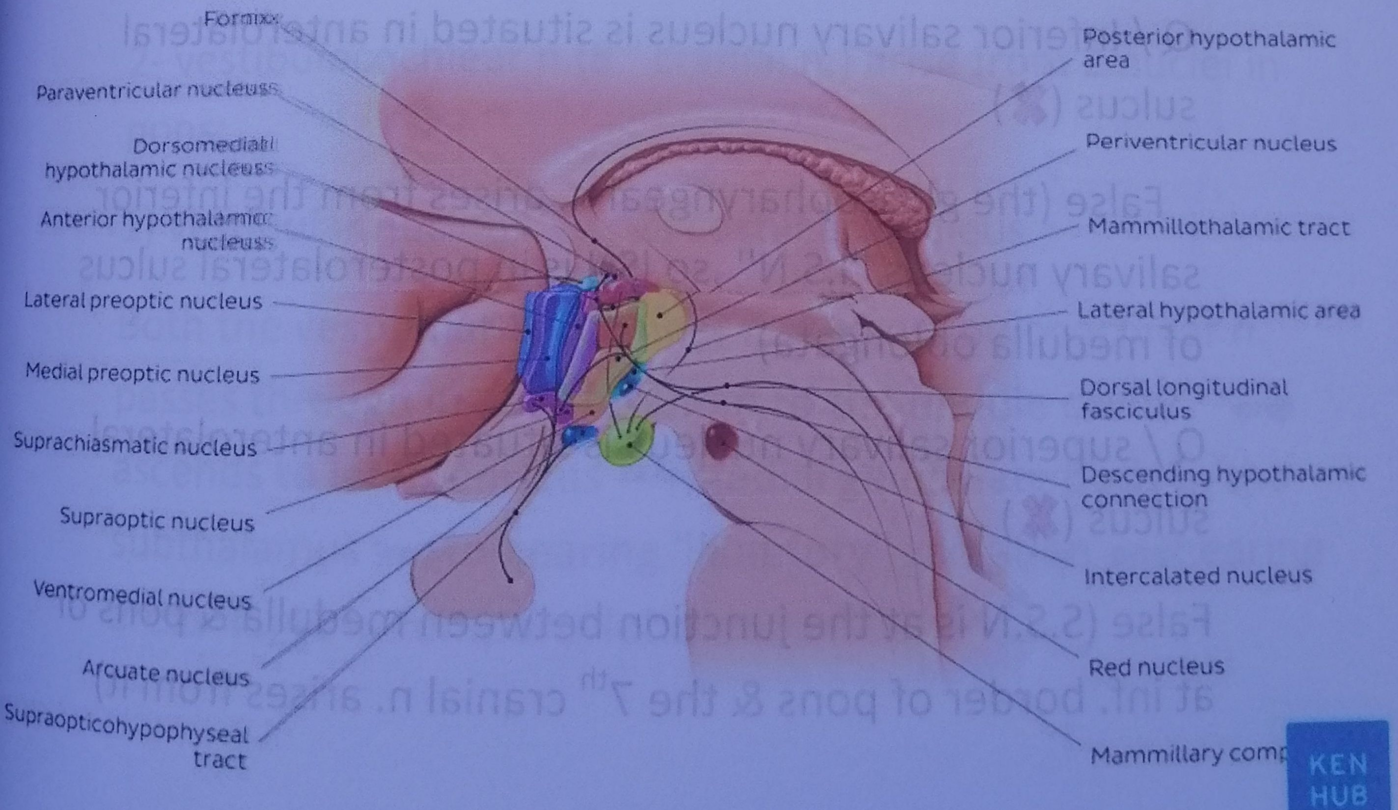
Related to optic chiasma

- **Structures forming the floor of hypothalamus:**

Q / Enumerate Structures forming the floor of hypothalamus

1) Posterior perforated substance
2) Mammillary body
3) Hypophyseal cerebri "pituitary gland"
4) optic chiasma


15
Corpus callosum
Fornix
thalamus
hypothalamic suclus
lat nucleus
medial nucleus
Post perforated substance
ant Commisure.
gray optic nucleus
supraoptic nucleus
optic chiasma.
tuberal optic
Pituitary gland
Post nucleus
ant. nucleus
mamillary body


Fornix
Paraventricular nucleus
Dorsomedial hypothalamic nucleus
Anterior hypothalamic nucleus
Lateral preoptic nucleus
Medial preoptic nucleus
Suprachiasmatic nucleus
Supraoptic nucleus
Ventromedial nucleus
Arcuate nucleus
Supraopticohypophyseal tract
Posterior hypothalamic area
Periventricular nucleus
Mammillothalamic tract
Lateral hypothalamic area
Dorsal longitudinal fasciculus
Descending hypothalamic connection
Intercalated nucleus
Red nucleus
Mammillary comp
KEN HUB

© www.kenhub.com

- **Blood supply:**

1- Thalamic artery
2- Hypothalamic artery → branch from middle cerebral a.

The middle cerebral a. is the largest a. which supplies the cerebrum (main source).

- Nuclei of the brainstem

- Nuclei in medulla oblongata:

4 nuclei for 4 cranial nerves:

1) Hypoglassal n.(12th cranial n.) → on anterolateral sulcus of medulla
2) Glossopharyngeal n.(9th cranial n.)
3) Vagus n.(10th cranial n.)
4) Accessory n.(11th cranial n.)

From above downward
posterolateral sulcus o
medulla

Q / Inferior salivary nucleus is situated in anterolateral sulcus (✗)

False (the glossopharyngeal n. arises from the inferior salivary nucleus "I.S.N" ,so ISN is in posterolateral sulcus of medulla oblongata)

Q / superior salivary nucleus is situated in anterolateral sulcus (✗)

False (S.S.N is at the junction between medulla & pons or at inf. border of pons & the 7th cranial n. arises from it)

- Nuclei in the pons:

4 nuclei for 4 cranial nerves:

1- Trigeminal n.(5th cranial n.) → situated on the anterolateral surface of pons or at the junction between the pons & middle cerebellar peduncle.

2- Abducent n.(6th cranial n.) → situated along the basilar sulcus or in the middle of pons.

3) Facial n.(7th cranial n.)

4) Auditory n. (8th cranial n.)

Situated at the junction between pons & medulla or at the lower border of pons (the 7th C.N laterally & the 8th C.N medially)

Note:

1- The facial n.(7th C.N) is the only cranial n. which its fibers aren't directly coming down (it circulate the 6th cranial n.)

2- vestibulocochlear n.(8th cranial n.) arise from 2 nuclei in pons:

1) vestibular nucleus 2) cochlear nucleus

Both the vestibular & cochlear n. → vestibulocochlear n. passes through jugular foramen to the middle cavity → ascends to lat. meniscus → medial geniculate body in the subthalamus → to hearing "auditory" radiation → hearing areas 41,42 in temporal lobe.

3- Nuclei of the midbrain:

4 nuclei (2 cranial nuclei & 2 pigmented nuclei)

- 2 cranial nuclei :

1) Occulomotor n.(3rd C. N) → on ant. surface (on ventral lip of cerebral aquiduct)

2) Trochlear n. (4th C.N) → on post. Surface (on dorsal lip of cerebral aquiduct)

- 2 pigmented nuclei :

1) red nucleus

2) substantia nigra

Situated on the ant. surface tegmentum

- Definition of substantia nigra:

Pigmented area situated in the tegmentum of midbrain between the cerebral peduncle & red nucleus.

Note:

- main tract that arise from the red nucleus → ruberospinal tract.

- midbrain divided into :

1- large part (ant.) " Tegmentum" where nuclei are located.

2- small part (post.) "Tectum".

Q / all the nuclei are located in the ant. part "Tegmentum".

Q / pigmented nerve nuclei are located in midbrain.

Q / pigmented nuclei are located in midbrain in tegmentum (ant. part).

❖ Tracts:

Q / name the main ascending tracts of spinal cord.

1) Gracile tract ➡ (medially) ,origin: nucleus gracilius.
2) Cuneatus tract ➡ (laterally) ,origin: nucleus cuneatus.

Q / name the main descending tracts of spinal cord.

1) Pyramidal tract ➡ situated in the ant. column.
2) Olivospinal tract.

Q / what are the tracts located in the ant. column of spinal cord?

Inferior & lateral pyramidal tract.

Q / what are the tracts located in the lat. column of spinal cord?

Anterior & posterior spinocerebellar tract.

Basal ganglia

They are scattered nuclei situated within the diencephalon

Consist of 5 nuclei ;

1-caudate nucleus .

2- lentiform nucleus.

3-external capsule.

4-clustorum

5-amygdaliod body

1-first caudate nucleus :

Made up of :

(head ,body ,tail)

❖ **Relations**:

Inferiorly :the lentiform nucleus

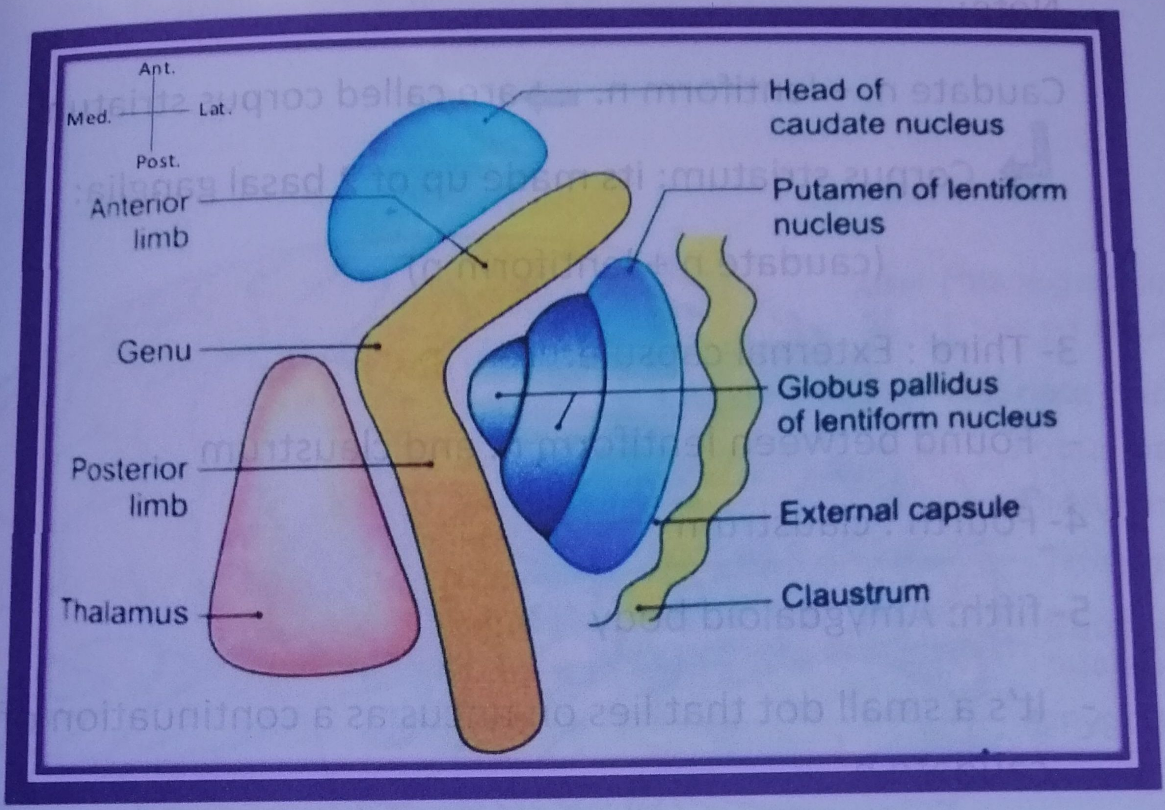
Posteromedially ; thalamus

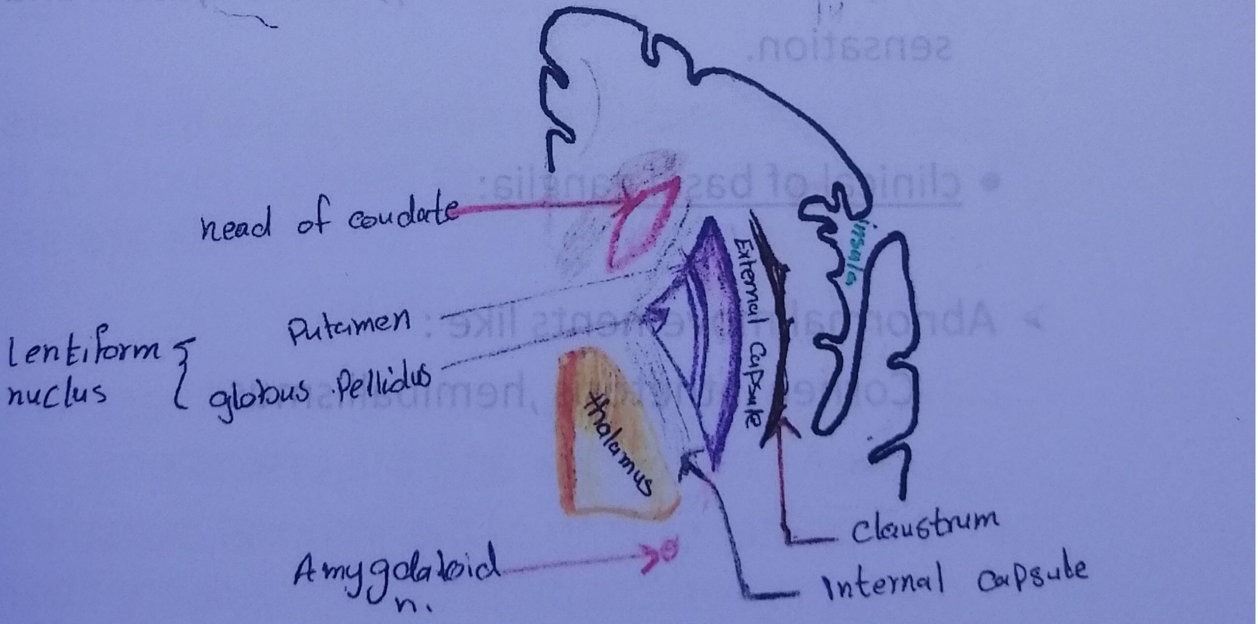
2- second : lentifrom nucleus:

- Made of 2 parts: 1- Inner triangle → globus polidus
  2- Outer arch → putamen

❖ **Relations**:

- Medially: internal capsule and thalamus
- Laterally: external capsule and claustrum
- Superiorly: head of caudate nucleus
- Inferiorly: sublentiform and subthalamic structures:
  - Lat. Geniculated body
  - Med. Geniculated body


Ant.
Med.
Lat.
Post.
Anterior limb
Genu
Posterior limb
Thalamus
Head of caudate nucleus
Putamen of lentiform nucleus
Globus pallidus of lentiform nucleus
External capsule
Claustrum


head of caudate
Lentiform nuclus
Putamen
globus Pellidus
Amygdaloid n.
thalamus
External capsule
insula
Claustrum
Internal capsule

Note:

Caudate n. + lentiform n. → are called corpus striatum

↳ Corpus striatum: its made up of 2 basal ganglia:

(caudate n + lentiform n)

3- Third : External capsule:

- Found between lentiform n. and claustrum

4- Fourth : claustrum

5- fifth: Amygdaloid body

- It's a small dot that lies on uncus as a continuation of caudate n.

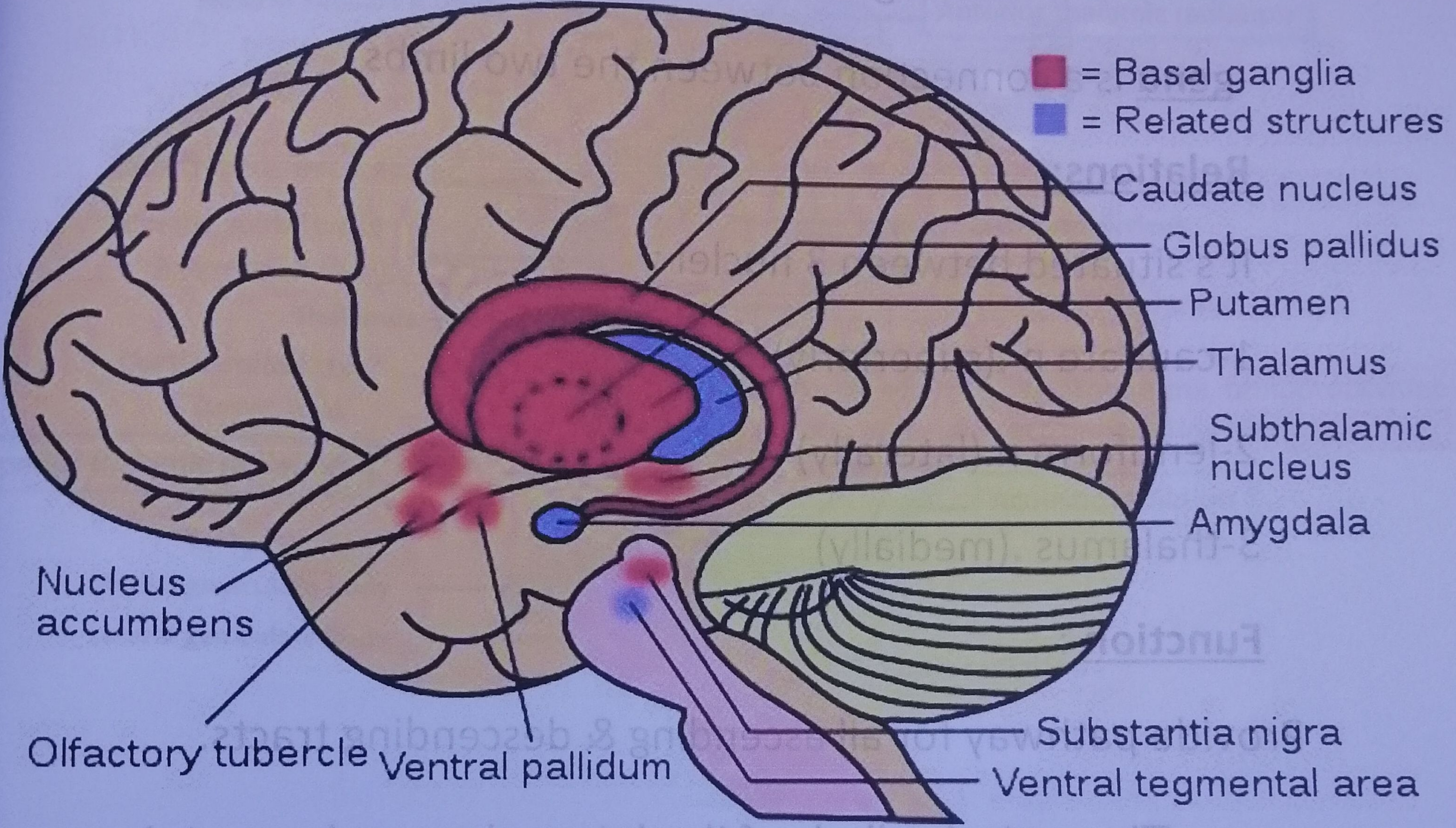
- Functions of basal ganglia:

  Still unknown (under research), but some believe that they are related to memory, limbic system and sensation.

- clinical of basal ganglia:

➢ Abnormal movements like :

Cornea ,athetosis ,hemiballismus.


🟥 = Basal ganglia
🟦 = Related structures
Caudate nucleus
Globus pallidus
Putamen
Thalamus
Subthalamic nucleus
Amygdala
Nucleus accumbens
Olfactory tubercle
Ventral pallidum
Substantia nigra
Ventral tegmental area

INTERNAL CAPSULE

Definition : a v-shaped structure ,consists of lateral limb ,medial limb & genu & retrolentiform & sublentiform parts.

-**genu** is a connection between the two limbs .

Relations:

It's situated between 3 nuclei :

1-caudate n .(superiorly)

2-lentiform n.(laterally)

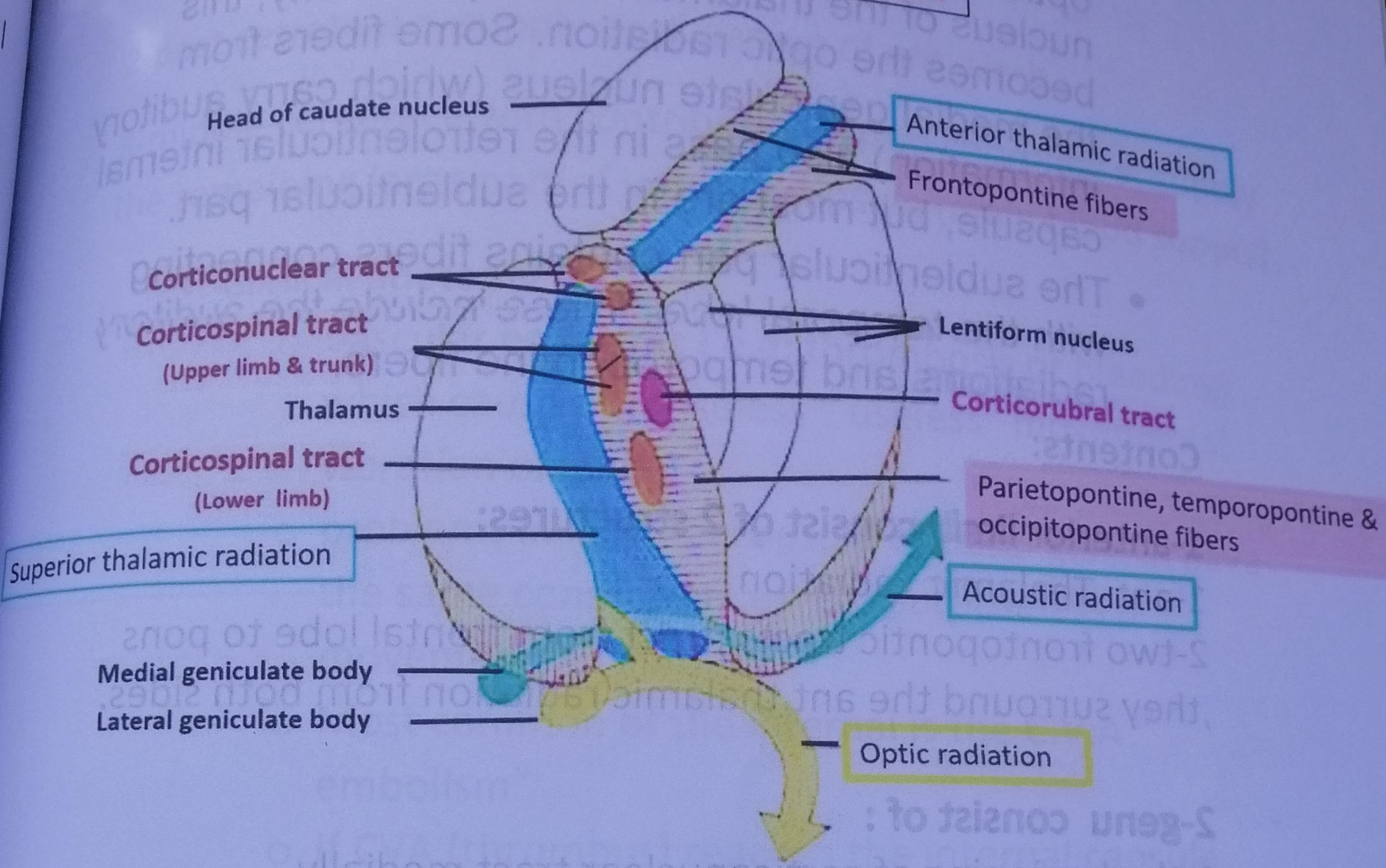
3-thalamus .(medially)

Function :

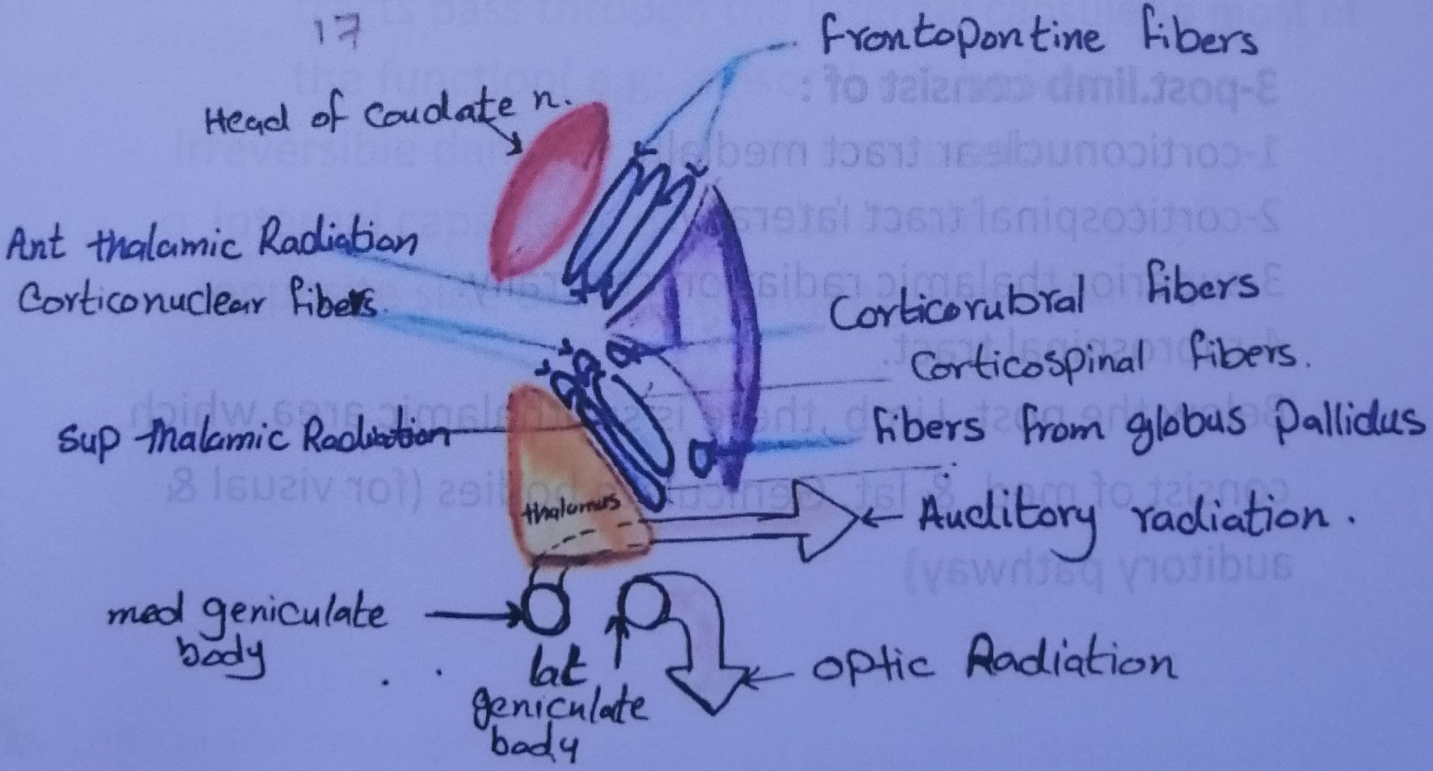
Provide pathway for all ascending & descending tracts.

- The anterior limb of the internal capsule contains:
  1) Frontopontine fibers project from frontal cortex to the pons;
  2) Thalamocortical radiations are the fibers that connect the medial and anterior nuclei of the thalamus to the frontal lobes (these are severed during a prefrontal lobotomy).
- The genu contains corticobulbar fibers, which run between the cortex and the brainstem.
- The posterior limb of the internal capsule contains corticospinal fibers, sensory fibers (including the medial lemniscus and the anterolateral system) from the body and a few corticobulbar fibers.

Constituent Fibers of Internal Capsule


Head of caudate nucleus
Anterior thalamic radiation
Frontopontine fibers
Corticonuclear tract
Corticospinal tract
(Upper limb & trunk)
Lentiform nucleus
Thalamus
Corticorubral tract
Corticospinal tract
(Lower limb)
Parietopontine, temporopontine & occipitopontine fibers
Superior thalamic radiation
Acoustic radiation
Medial geniculate body
Lateral geniculate body
Optic radiation

17


frontopontine fibers
Head of caudate n.
Ant thalamic Radiation
Corticonuclear fibers
Corticorubral fibers
Corticospinal fibers.
Sup thalamic Radiation
fibers from globus Pallidus
thalamus
Auditory radiation.
med geniculate body
lat geniculate body
optic Radiation

Other fibers within the internal capsule

- The retrolenticular part contains fibers from the optic system, coming from the lateral geniculate nucleus of the thalamus. More posteriorly, this becomes the optic radiation. Some fibers from the medial geniculate nucleus (which carry auditory information) also pass in the retrolenticular internal capsule, but most are in the sublenticular part.
- The sublenticular part contains fibers connecting with the temporal lobe. These include the auditory radiations and temporopontine fibers.

Contents:

1-anterior limb consist of 2 structures:

1-ant. Thalamic radiation

2-two frontopontic tracts ;tract from frontal lobe to pons ,they surround the ant.thalamic radiation from both sides.

2-genu consist of :

1-the beginning of corticonuclear tract medially.

2-the beginning of corticospinal (pyramidal)tract laterally.

3-post.limb consist of :

1-corticonuclear tract medially

2-corticospinal tract laterally.

3-superior thalamic radiation centrally.

4-rubrospinal tract.

Below the post. Limb ,there is subthalamic area which consist of med. & lat. Geniculate bodies (for visual & auditory pathway)

Blood supply :

1-two branches from ant. cerebral a (one of them is called recurrent branch) supply ant. Part of ant. Limb.

2-post.cetrebral a :supply post. aspect of ant. Limb.

3-middle cerebral a with contributions from choroidal a: supply the remaining large part of internal capsule (main blood supply).

- Clinical anatomy:
  - Vascular problems (e.g: thrombosis or bleeding) , which cause purposeless “ useless” movements(vibration of limbs)
  - problems in internal capsule or basal ganglia have the same consequences i.e: purposeless of movements of limbs
  - Most common of the internal is the C.V.A “ embolism”
  - If CVA (thrombus) reaches the internal capsule, irreversible damage will occur because all the tracts pass through the internal capsule so most of the function(e.g: sensory) will be lost

- irreversible damage: can't be treated
  - Internal capsule stroke cause dense hemiplegia in opposite side of body (Complete paralysis).

Limbic system

- definition : The center of emotional integration
- site : at the junction between diencephalon and telencephalon
- shape : C-shaped extends from hypothalamus to amygdaloid body

Note:

- Limbic system cannot work alone, but by integration with other structures.

- components:

  1) olfactory group (olfactory nucleus, mucosa, nerve, tract, bulb ,straie ,trigone and olfactory terminals)

  2) piriform lobe (uncus and parahippocampal gyrus)

  3) Amygdaloid nuclei and their efferent pathway

  4) Hippocampal formation(hippocampus, dentate gyrus, indusium griseum and longitudinal striae)

  5) limbic lobe (septal area, singulate gyrus, parahippocumpal gyrus)

  6) hypothalamus

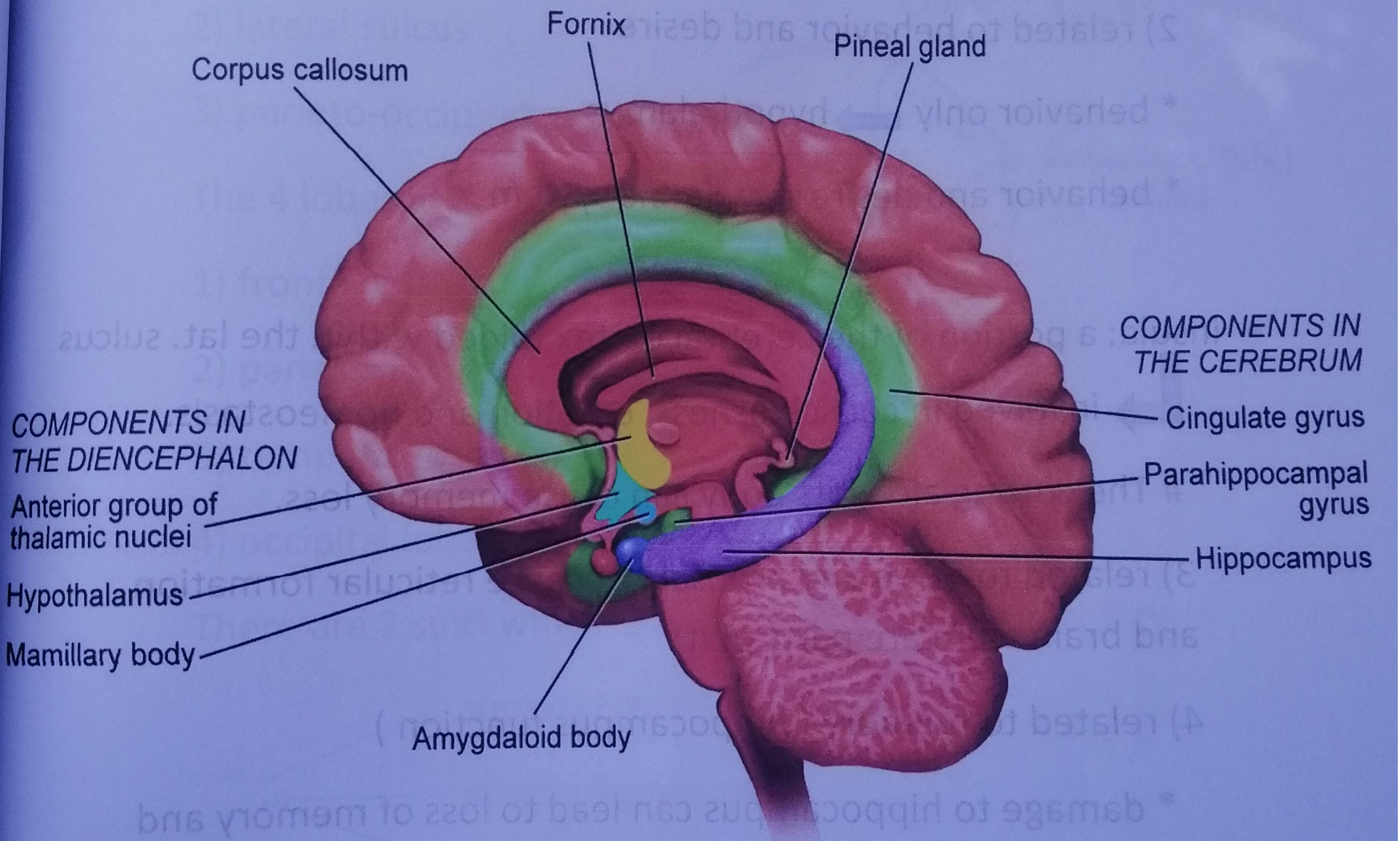
  7) anterior nuclei of thalamus

  8) habenularis stria, stria terminalis, fornix, anterior commissure.

  9) Tegmental nuclei of midbrain.(red nucleus and substantia nigra)

  10) Inter perpendicular nucleus

The Limbic System


Fornix
Corpus callosum
Pineal gland
COMPONENTS IN THE CEREBRUM
Cingulate gyrus
Parahippocampal gyrus
Hippocampus
COMPONENTS IN THE DIENCEPHALON
Anterior group of thalamic nuclei
Hypothalamus
Mamillary body
Amygdaloid body

11) insula limba mammillary body (from contents of hypothalamus)

↳ for recollective memory.

damage to it may cause anterograde amnesia.

- Functions:

1) center of small " olfaction" because it consists of olfactory group

2) related to behavior and desire

* behavior only → hypothalamus

* behavior and desire → limbic system

- insula: a portion of the cerebral cortex folded within the lat. sulcus

↳ involved in consciousness, emotion and homeostasis.

The cutting along its body can cause memory loss.

3) related to sleep and arousal (because reticular formation and brain stem are parts of it)

4) related to memory (hippocampus function)

* damage to hippocampus can lead to loss of memory and in Alzheimer's disease, the hippocampus is one of the first regions of the brain to be affected

5) related to fear (amygdaloid body function)

The_Cerebrum

- It's the upper and largest part of the brain.
- Its divided incompletely into rt. and lt. hemispheres by the median longitudinal cerebral fissure.
- corpus callosum (white matter) unites the 2 hemispheres.
- Each hemisphere is divided by 3 main sulci into 4 lobes.

○ The 3 main sulci are :

1) central sulcus

2) lateral sulcus

3) parieto-occipital sulcus

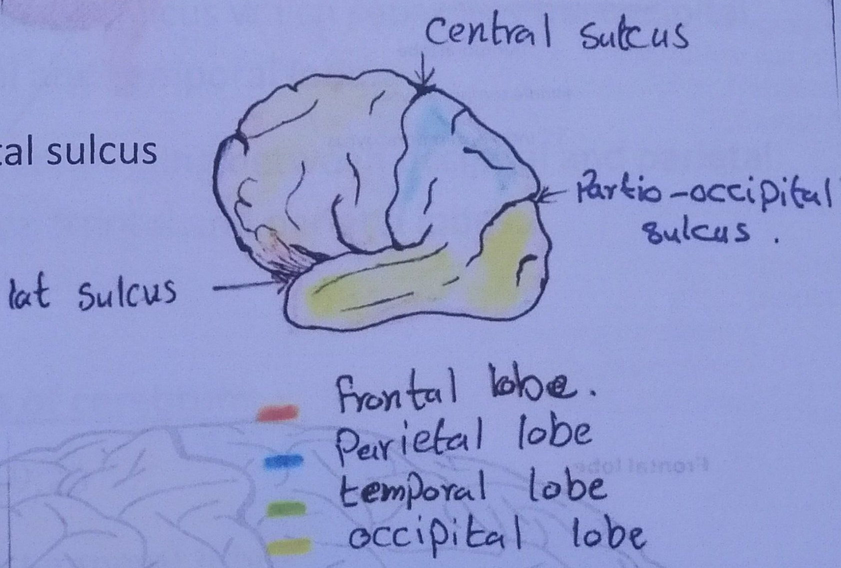
The 4 lobes are:

1) frontal lobe

2) parietal lobe

3) temporal lobe

4) occipital lobe


Central Sulcus
Partio-occipital sulcus .
lat Sulcus
🟥 frontal lobe.
🟦 Parietal lobe
🟩 temporal lobe
🟨 occipital lobe

There are 2 sulci which divide the frontal lobe into 3 gyri:

superior frontal gyrus

middle frontal gyrus

inferior frontal gyrus

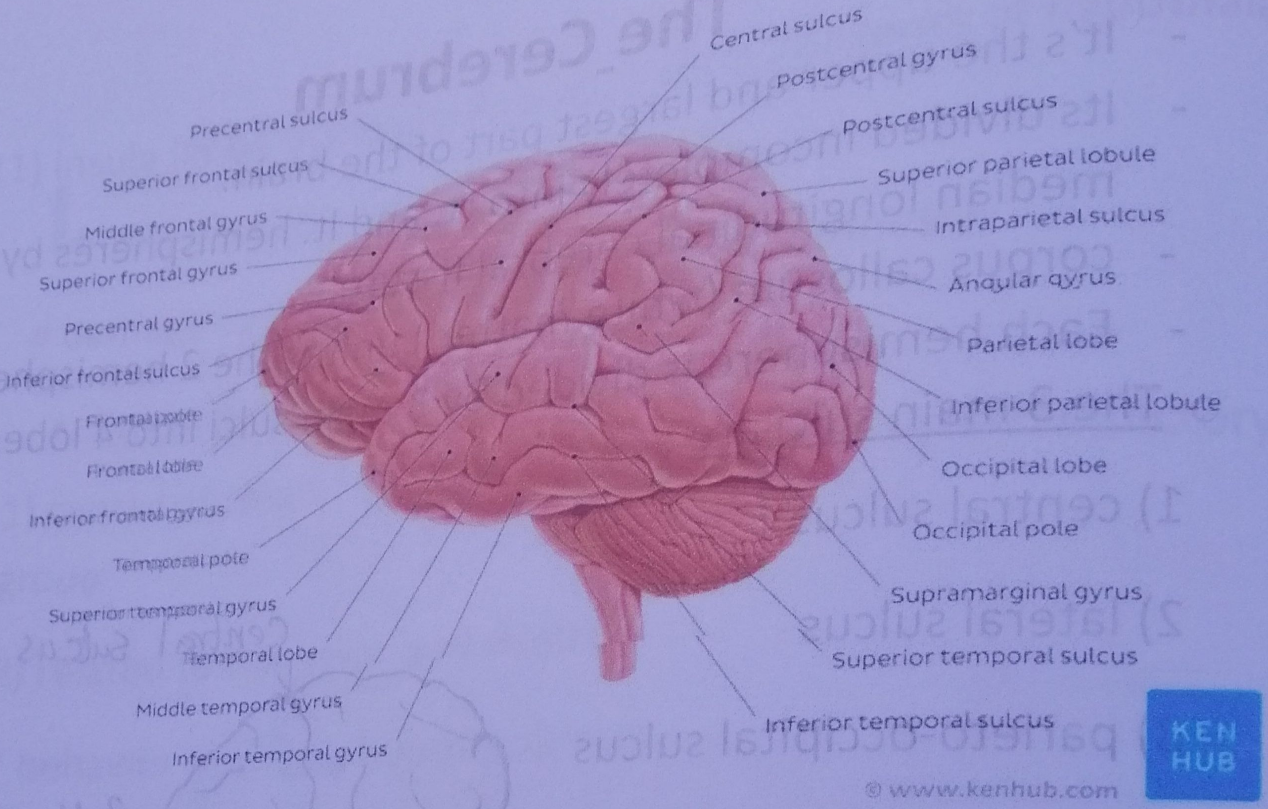
There are 2 sulci which divide temporal lobe into 3 gyri

↳ superior temporal sulcus

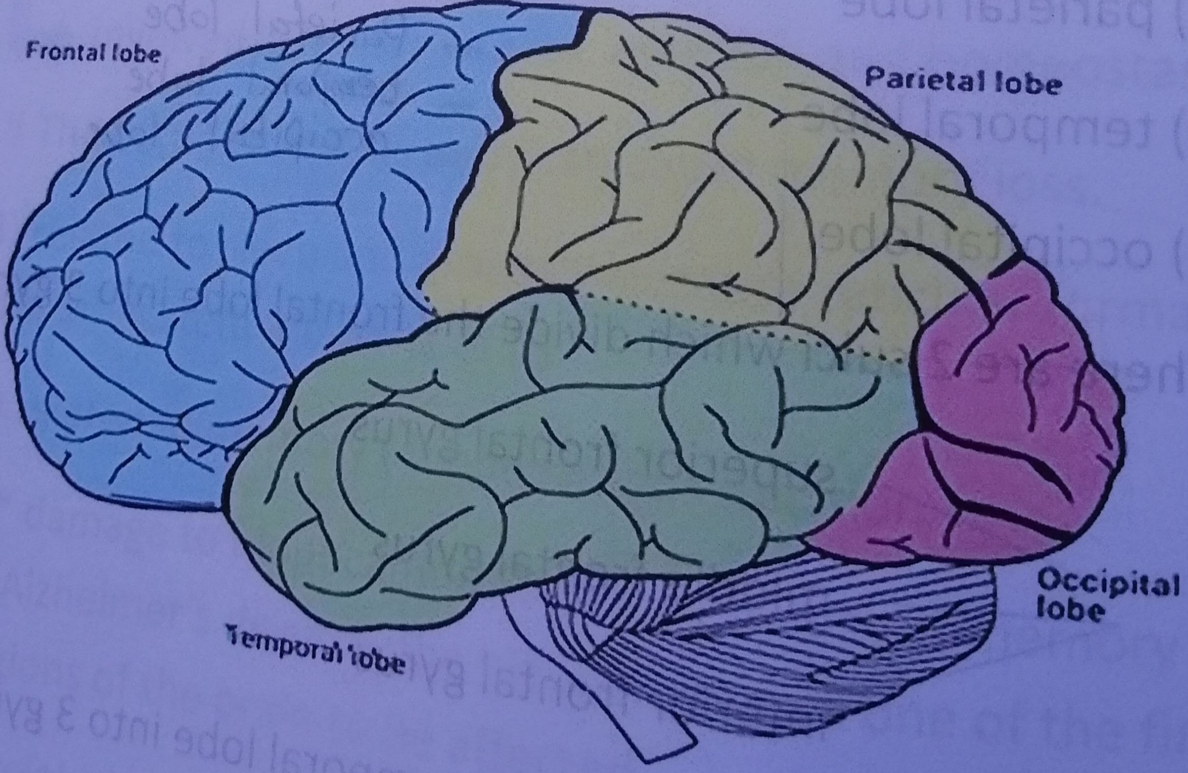
sup. temporal gyrus

inferior temporal sulcus — middle temporal gyrus

inferior temporal gyrus


Central sulcus
Postcentral gyrus
Precentral sulcus
Postcentral sulcus
Superior frontal sulcus
Superior parietal lobule
Middle frontal gyrus
Intraparietal sulcus
Superior frontal gyrus
Angular gyrus
Precentral gyrus
Parietal lobe
Inferior frontal sulcus
Inferior parietal lobule
Frontal pole
Frontal lobe
Occipital lobe
Inferior frontal gyrus
Occipital pole
Temporal pole
Supramarginal gyrus
Superior temporal gyrus
Temporal lobe
Superior temporal sulcus
Middle temporal gyrus
Inferior temporal sulcus
Inferior temporal gyrus
KEN HUB

© www.kenhub.com


Frontal lobe
Parietal lobe
Occipital lobe
Temporal lobe

- Occipito-parietal sulcus extends from occipital to parietal lobes which forms 2 gyri:

  1) superior occipito-parietal gyrus

  2) inferior occipto-parietal gyrus

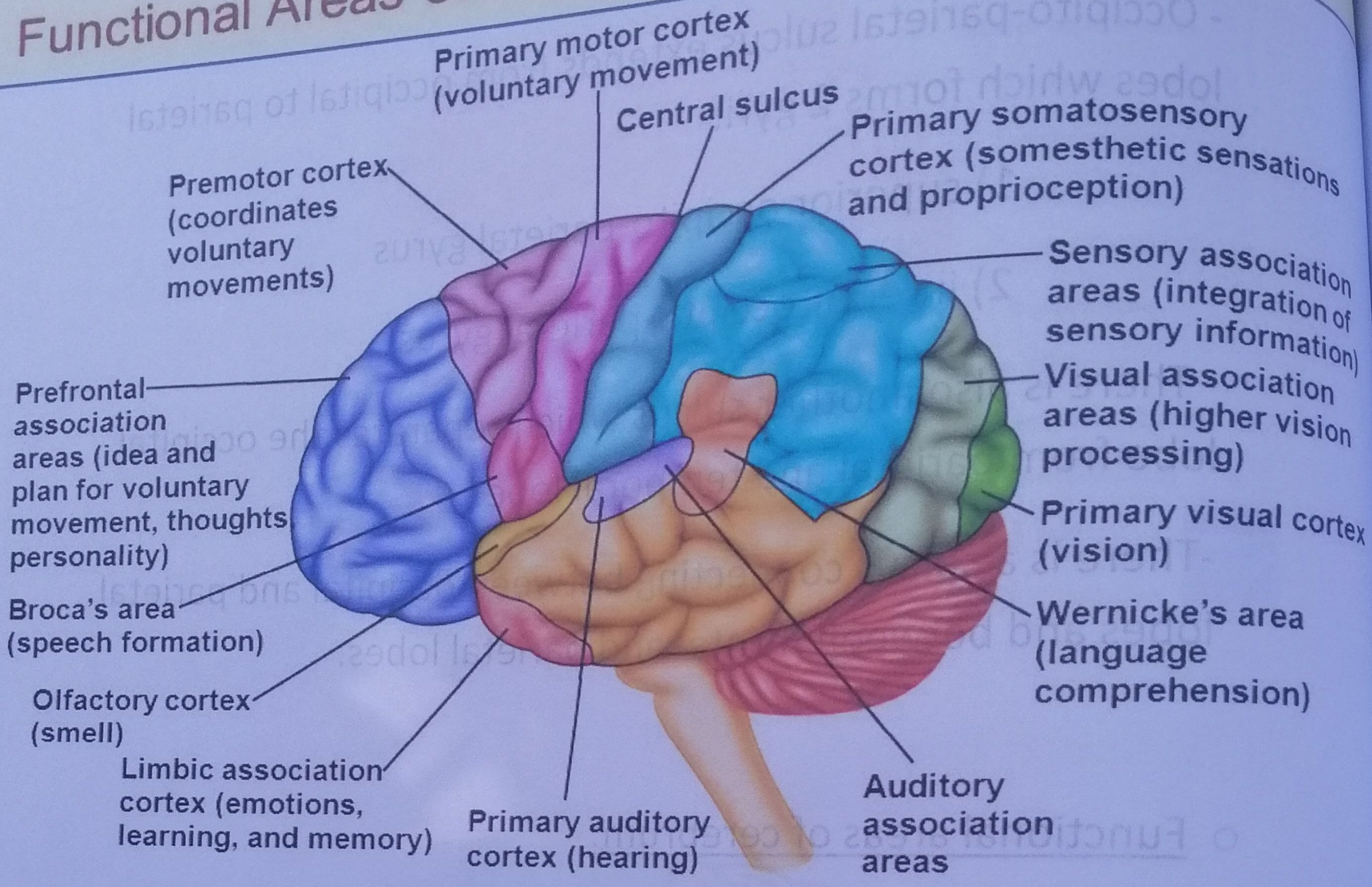
- There is also another sulcus which separates the occipital lobe from parietal and temporal lobe.

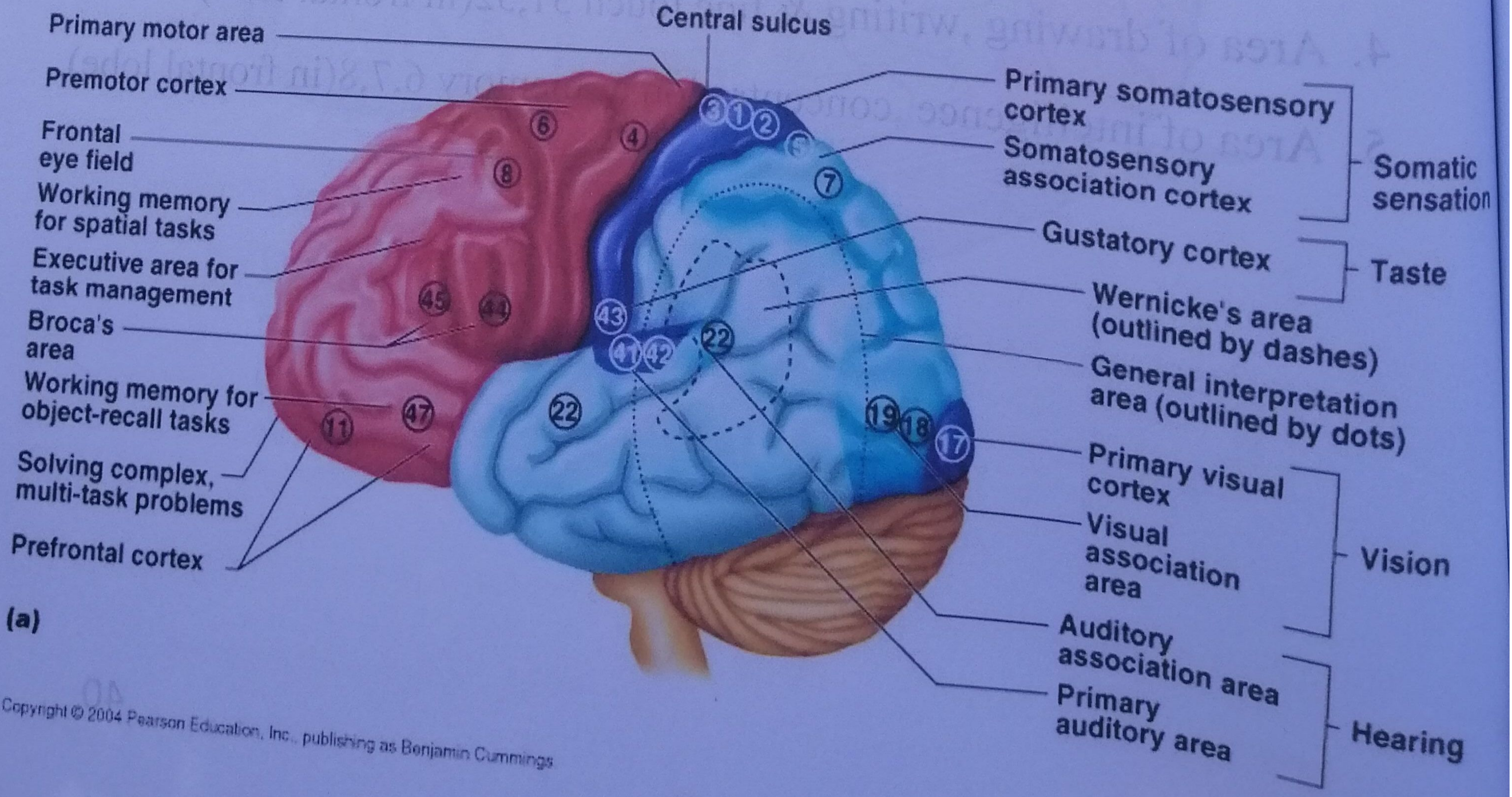
-There is a sulcus connecting between occipital and parietal lobes and between frontal and parietal lobes.

- Functional areas of cerebrum:

1. Visual area 17,18,19,20
2. Hearing area 41,42(temporal lobe)
3. Motor & sensory areas 4,3,1,2,5(in parietal lobe)
4. Area of drawing ,writing & fine touch 31,32(in frontal lobe)
5. Area of intelligence ,concentration & memory 6,7,8(in frontal lob

Functional Areas of Cerebrum

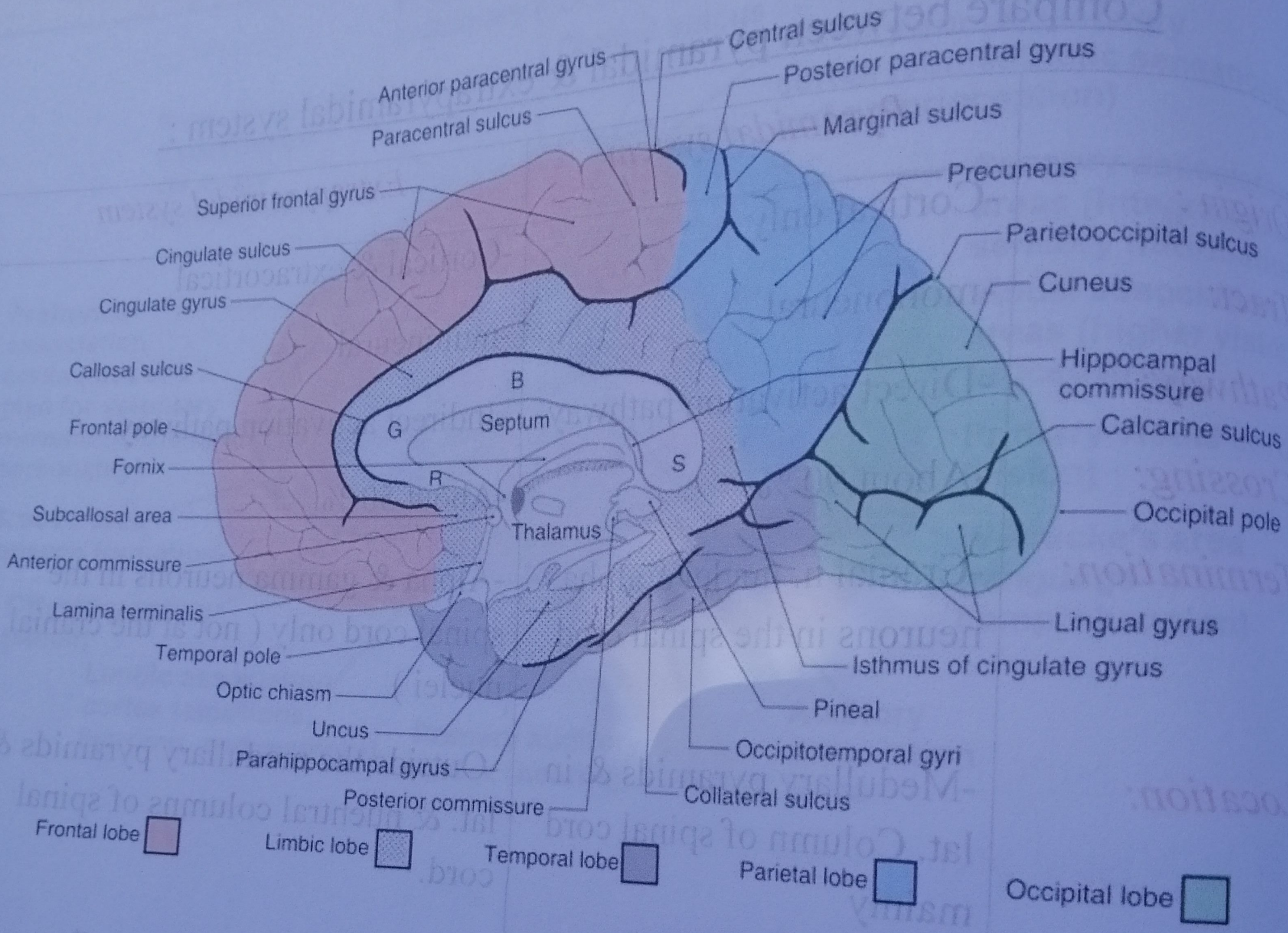

Primary motor cortex (voluntary movement)
Central sulcus
Primary somatosensory cortex (somesthetic sensations and proprioception)
Premotor cortex (coordinates voluntary movements)
Sensory association areas (integration of sensory information)
Prefrontal association areas (idea and plan for voluntary movement, thoughts, personality)
Visual association areas (higher vision processing)
Primary visual cortex (vision)
Broca's area (speech formation)
Wernicke's area (language comprehension)
Olfactory cortex (smell)
Limbic association cortex (emotions, learning, and memory)
Primary auditory cortex (hearing)
Auditory association areas


Primary motor area
Central sulcus
Premotor cortex
Frontal eye field
Working memory for spatial tasks
Executive area for task management
Broca's area
Working memory for object-recall tasks
Solving complex, multi-task problems
Prefrontal cortex
(a)
Primary somatosensory cortex
Somatosensory association cortex
Somatic sensation
Gustatory cortex
Taste
Wernicke's area (outlined by dashes)
General interpretation area (outlined by dots)
Primary visual cortex
Visual association area
Vision
Auditory association area
Primary auditory area
Hearing
6
4
8
3
1
2
5
7
45
44
43
41
42
22
22
47
11
19
18
17

Copyright © 2004 Pearson Education, Inc., publishing as Benjamin Cummings

Compare between pyramidal & extrapyramidal system :

	Pyramidal system	Extrapyramidal system
*Origin :	-Cortical only	-Cortical & extracortical
*Tract:	-mononeural	-multineural
*Pathway:	-Direct activation pathway	-Indirect activation pathway
*Crossing:	-About 90 %	-About 50 %
*Termination:	-Cranial n. nuclei &alpha neurons in the spinal crod	-Alpha & gamma neurons in the spinal cord only (not at the cranial nuclei)
*Location:	-Medullary pyramids & in lat. Column of spinal cord mainly	-Outside the medullary pyramids & i lat. & nuentral columns of spinal cord.
*Time of function:	-Only after 1st year of life	-During & after the 1st year
*Function:	-Initiates fine skilled voluntary movements & increases the muscle tone	-Initiates gross & associated movements, decreases muscles tone & controls autonomic function


Central sulcus
Anterior paracentral gyrus
Posterior paracentral gyrus
Paracentral sulcus
Marginal sulcus
Precuneus
Superior frontal gyrus
Cingulate sulcus
Parietooccipital sulcus
Cuneus
Cingulate gyrus
Hippocampal commissure
Callosal sulcus
B
Septum
G
Calcarine sulcus
Frontal pole
S
Fornix
R
Occipital pole
Subcallosal area
Thalamus
Anterior commissure
Lamina terminalis
Lingual gyrus
Temporal pole
Isthmus of cingulate gyrus
Optic chiasm
Pineal
Uncus
Occipitotemporal gyri
Parahippocampal gyrus
Collateral sulcus
Posterior commissure
Frontal lobe
Limbic lobe
Temporal lobe
Parietal lobe
Occipital lobe

Corpus callosum

Definition : is a large C shaped nerve fiber bundle found beneath the cerebral cortex, it stretches across the midline of the brain, connecting the right and left hemispheres

Parts: The corpus callosum has four main parts:

a) The rostrum
b) The genu
c) The body
d) The splenium

Types of fibers:

1) **Commissural fibers :** are axons that connect the two hemispheres of the cerebrum.

❖ **Pathway:**

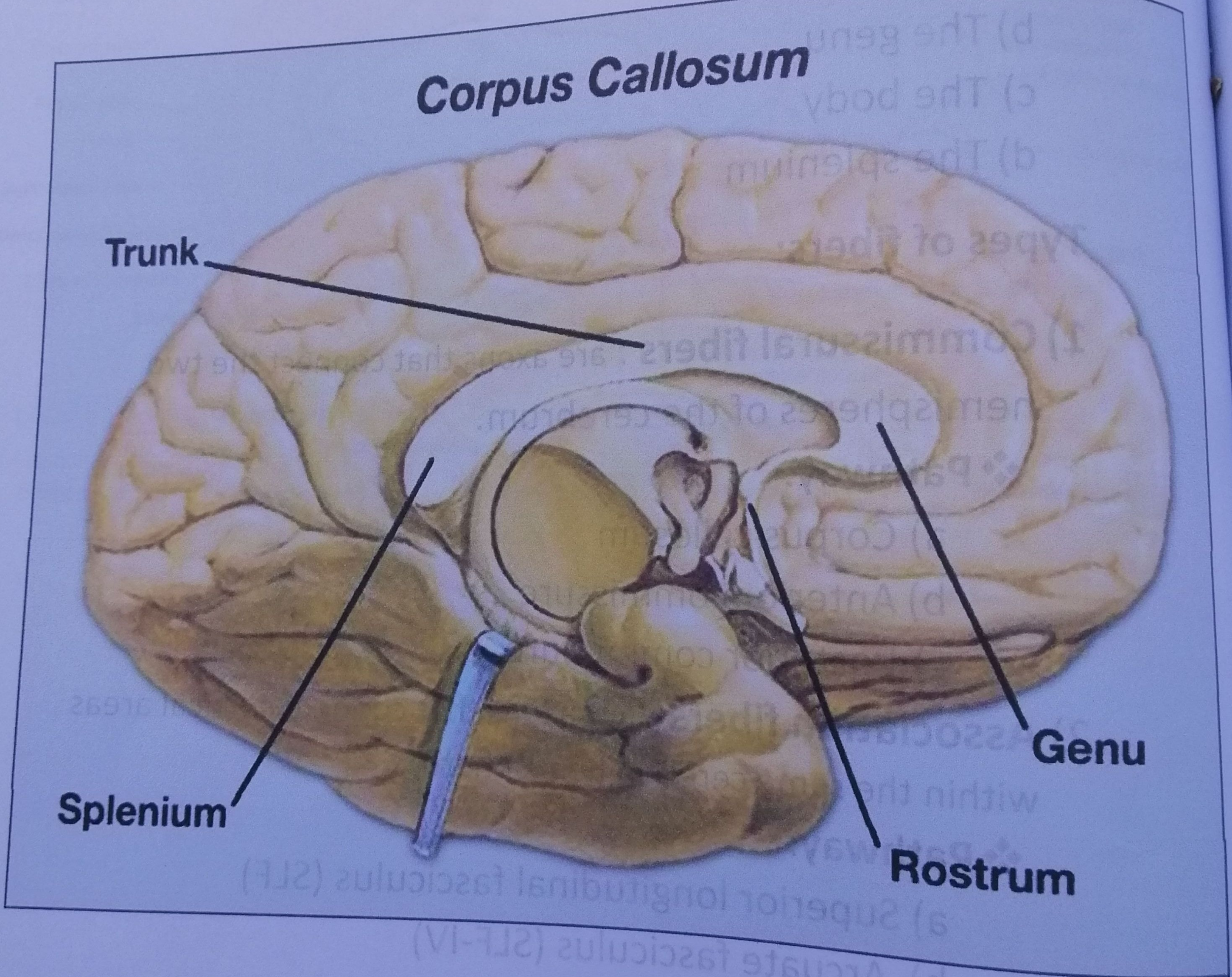
a) Corpus callosum
b) Anterior commissure
c) Posterior commissure

2) **Association fibers :** are axons that connect cortical areas within the same cerebral hemisphere.

❖ **Pathway:**

a) Superior longitudinal fasciculus (SLF)
b) Arcuate fasciculus (SLF-IV)
c) Inferior frontal occipital fasciculus
d) Inferior longitudinal fasciculus
e) Middle longitudinal fasciculus
f) Optic radiations
g) Frontal aslant tract
h) Uncinate fasciculus

3) **Projection fibers:** are axon connecting cerebral cortex with different parts of the brain and spinal cord


Corpus Callosum
Trunk
Splenium
Genu
Rostrum

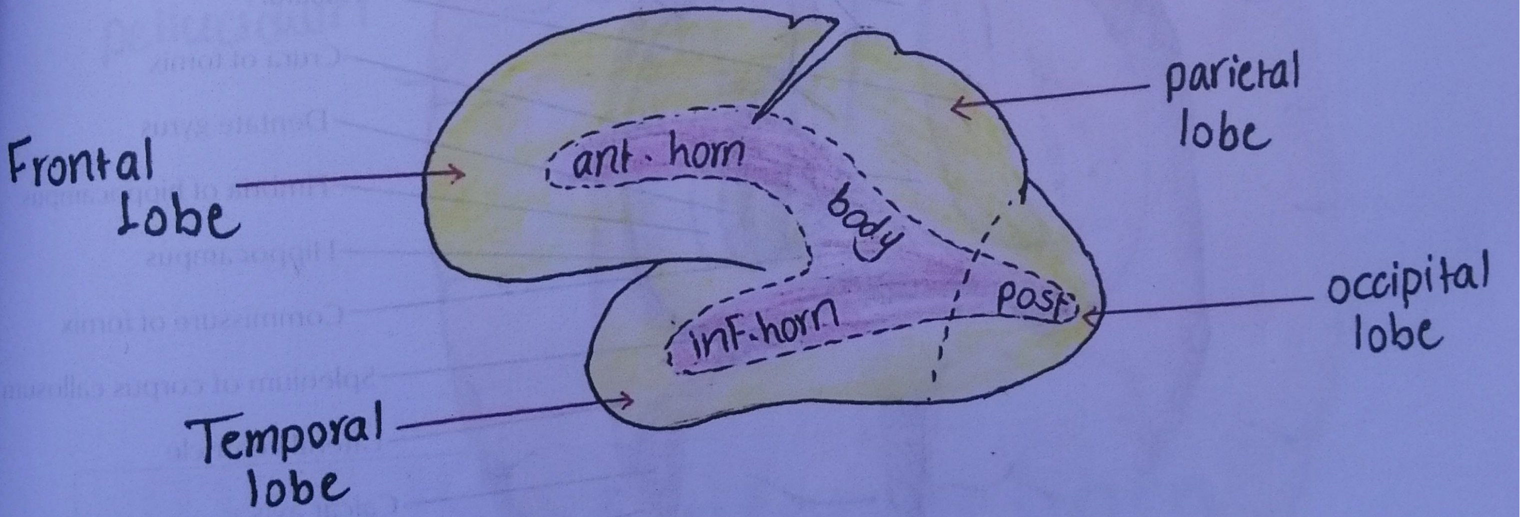
Ventricles of C.N.S

Lateral ventricle

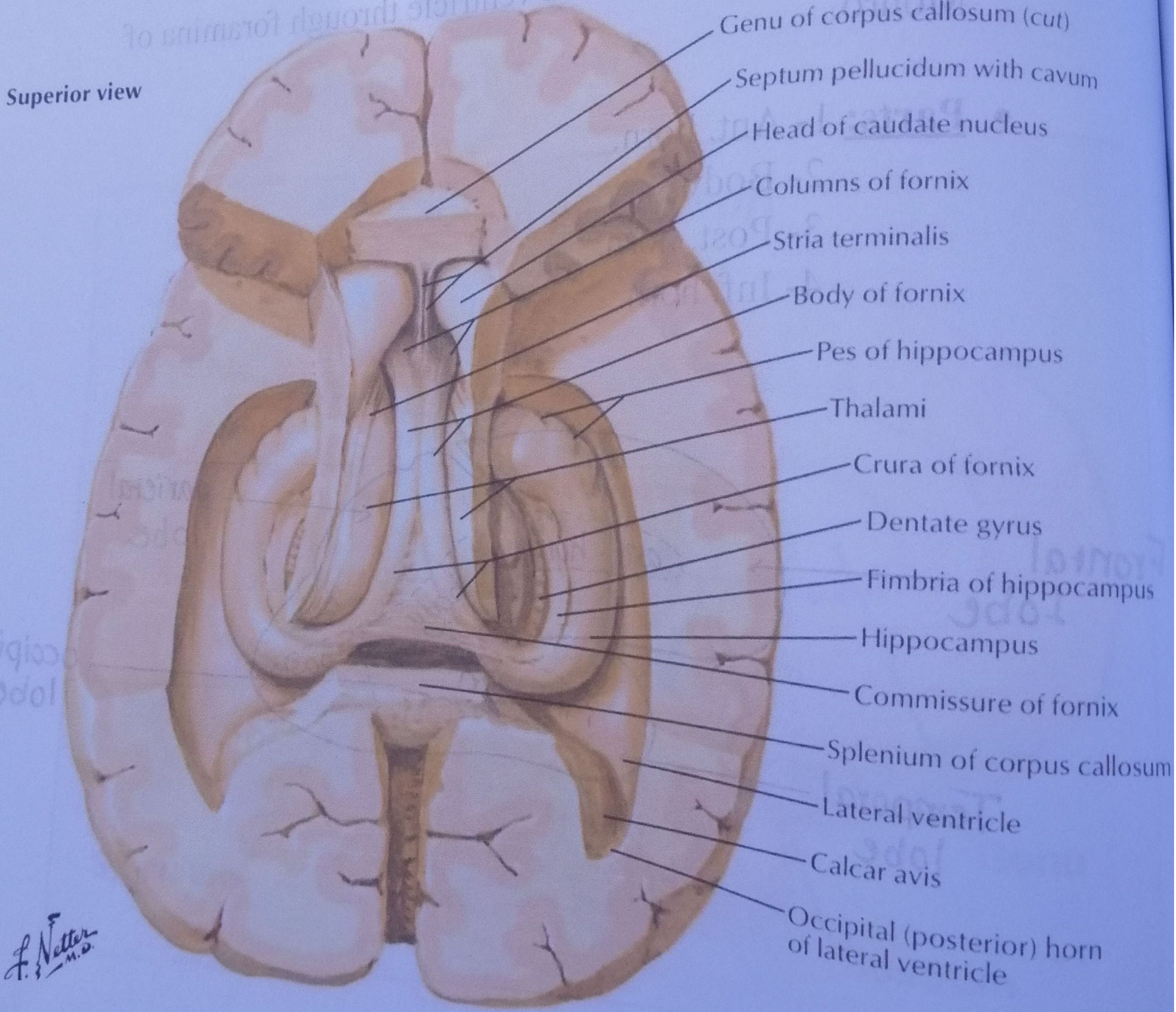
- **Definition:** It is the cavity of telencephalon.
  It secrete 70% of C.S.F.

- **Connection:** to the third ventricle through foramina of Monro.

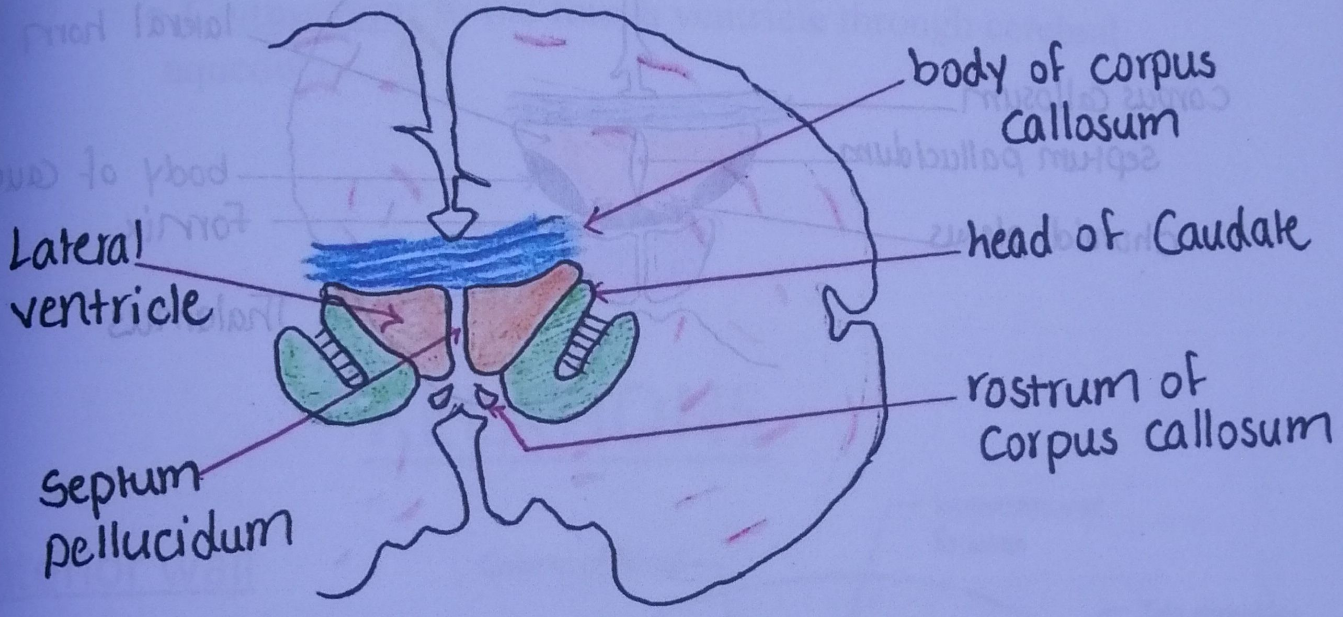
- **Parts:** 1- Ant. horn.
  2- Body.
  3- Post. horn.
  4- Inf. horn.


parietal lobe
Frontal Lobe
ant. horn
body
post
occipital lobe
inf. horn
Temporal lobe

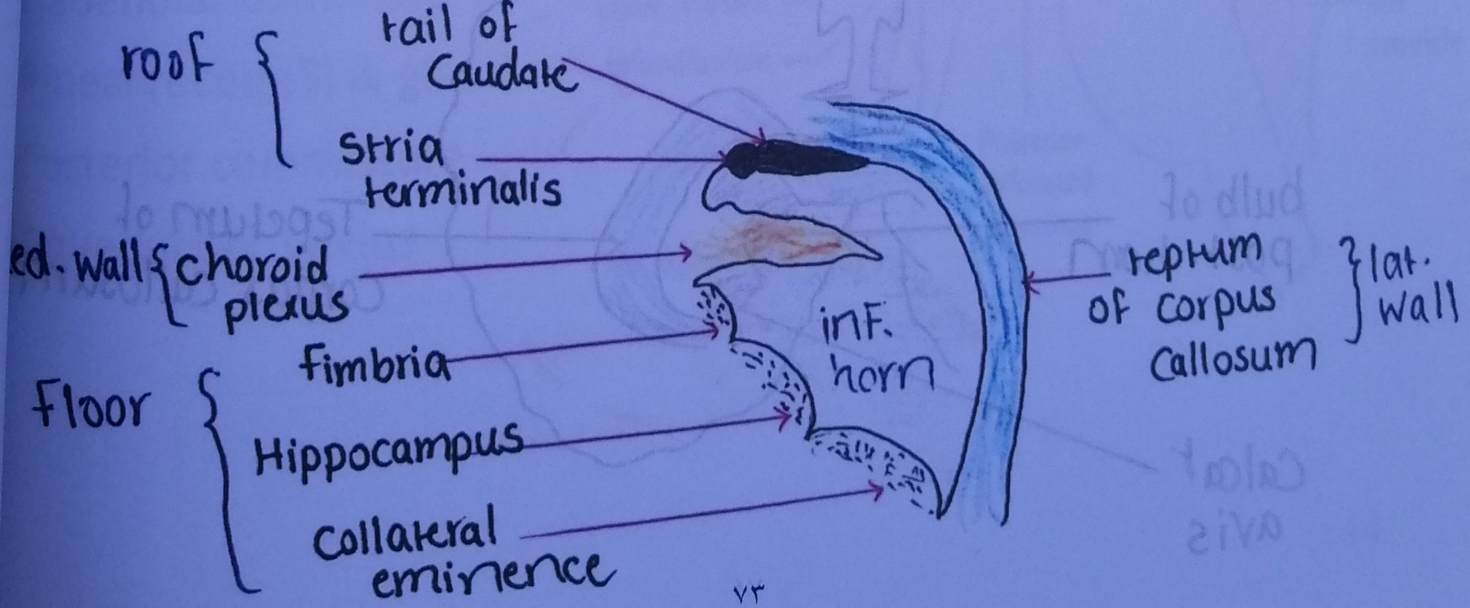
- **Relations:**


Superior view
Genu of corpus callosum (cut)
Septum pellucidum with cavum
Head of caudate nucleus
Columns of fornix
Stria terminalis
Body of fornix
Pes of hippocampus
Thalami
Crura of fornix
Dentate gyrus
Fimbria of hippocampus
Hippocampus
Commissure of fornix
Splenium of corpus callosum
Lateral ventricle
Calcar avis
Occipital (posterior) horn of lateral ventricle
F. Netter M.D.

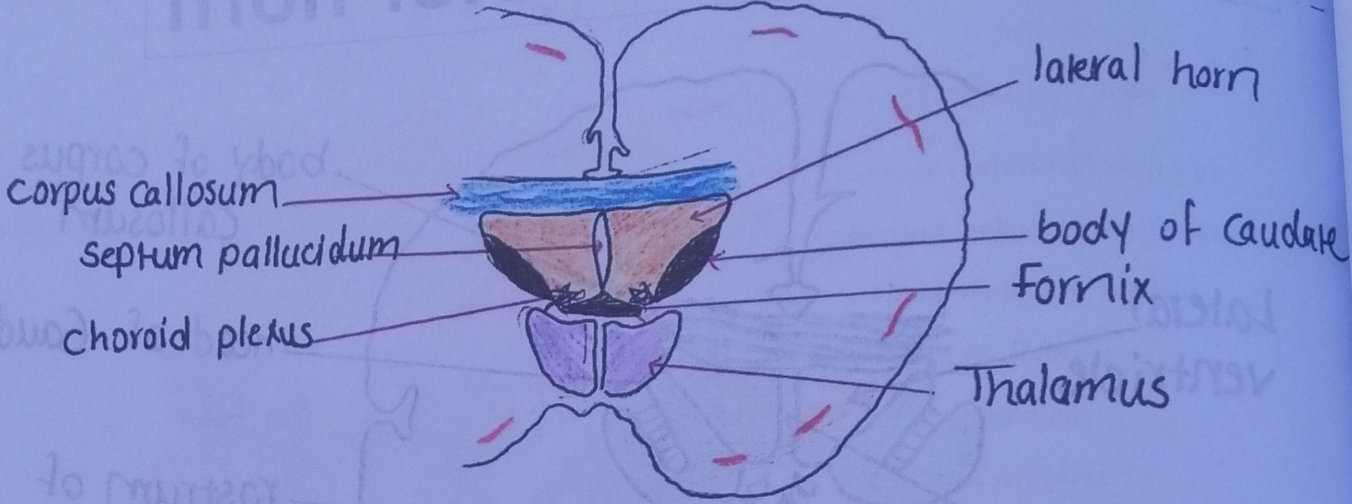
Relation of Anterior horn


body of corpus callosum
Lateral ventricle
head of Caudate
rostrum of Corpus callosum
Septum pellucidum

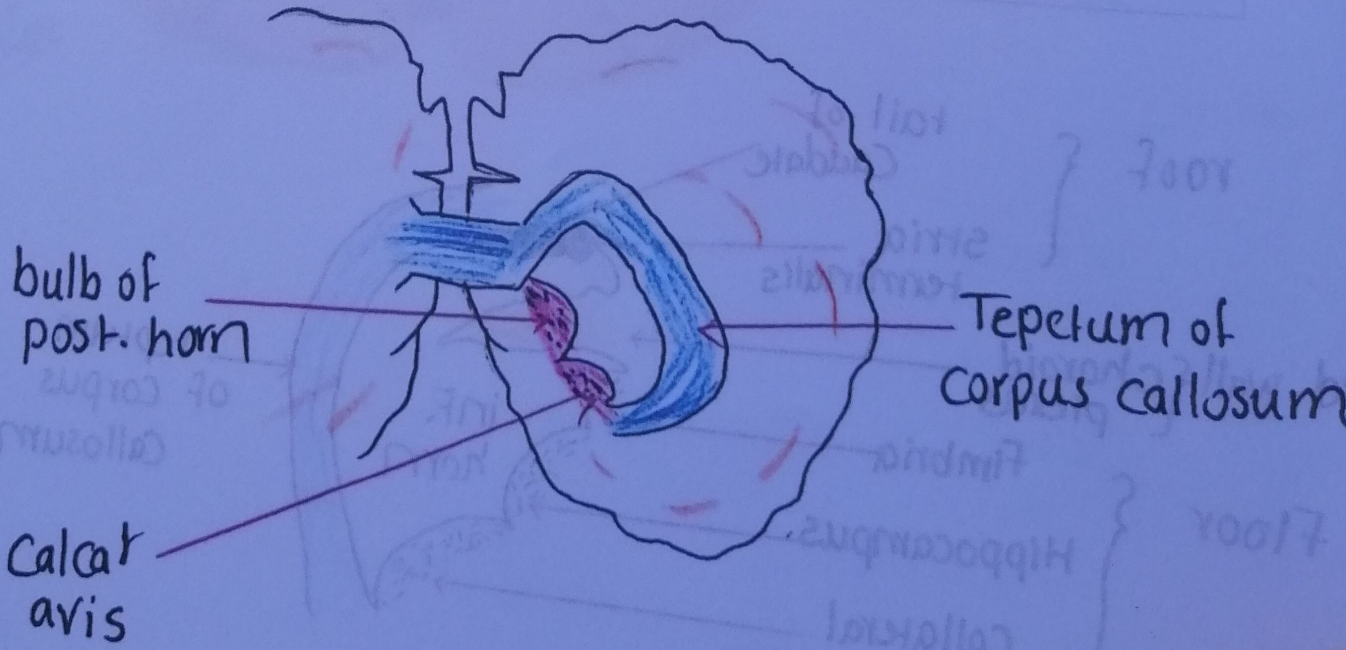
Relation of inferior horn


roof
tail of Caudate
Stria terminalis
ed. Wall
choroid plexus
Fimbria
Floor
Hippocampus
Collateral eminence
inf. horn
teptum of corpus Callosum
lat. wall

Relation of body of lat. ventricle


lateral horn
corpus callosum
body of Caudate
septum pallucidum
Fornix
choroid plexus
Thalamus

Relation of posterior horn


bulb of post. horn
Tepetum of corpus callosum
Calcar avis

Third ventricle

- **Definition:** It is the cavity of diencephalon.

- **Connection:** to the fourth ventricle through cerebral aqueduct.

RELATIONS

- Anterior wall

-Foramen of Monro

-Anterior Commissure

-Lamina Terminalis

-Optic chiasma

- Posterior wall

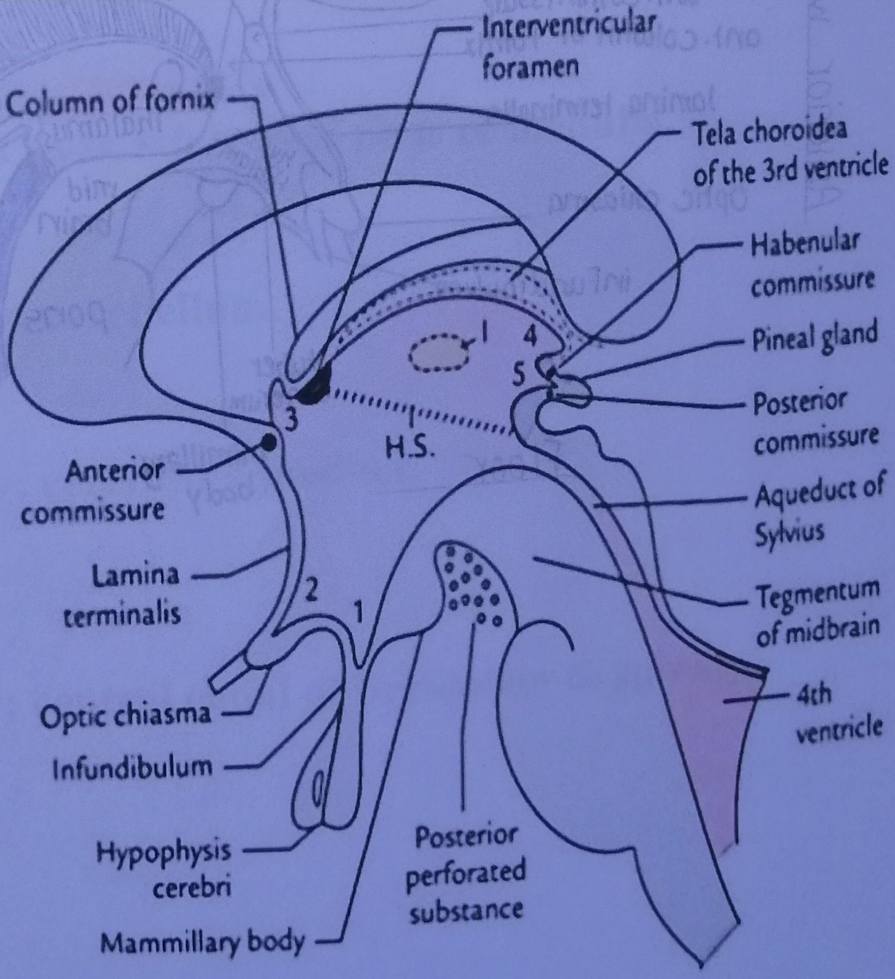
-Suprapineal rescess(4)

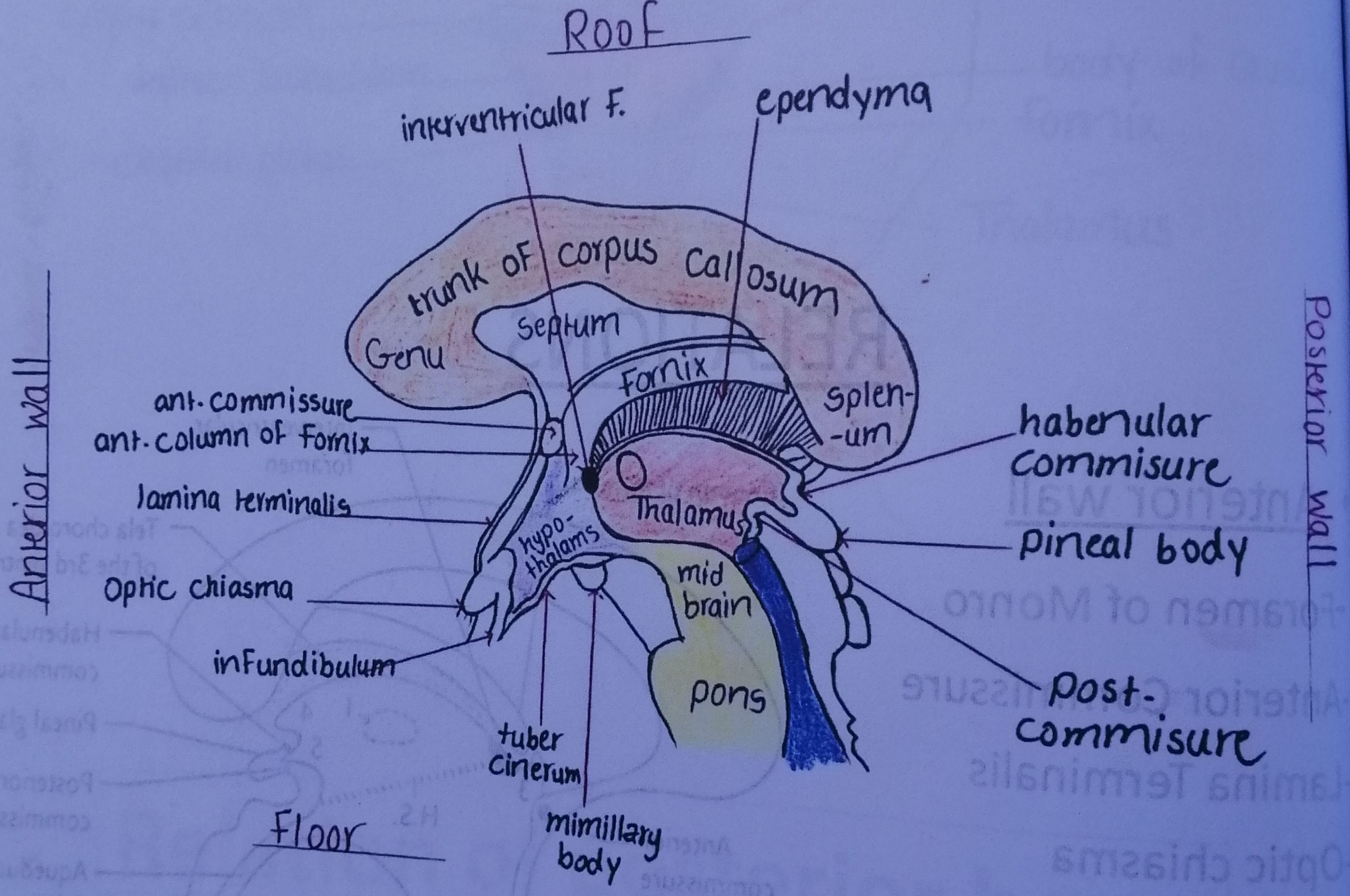
-Habenular commissure

-Pineal recess(5) & gland

-Posterior commissure

-Aqueduct of sylvius


Interventricular foramen
Column of fornix
Tela choroidea of the 3rd ventricle
Habenular commissure
Pineal gland
Posterior commissure
Aqueduct of Sylvius
Tegmentum of midbrain
4th ventricle
1
4
5
3
H.S.
2
Anterior commissure
Lamina terminalis
Optic chiasma
Infundibulum
Hypophysis cerebri
Mammillary body
Posterior perforated substance


Roof
interventricular F.
ependyma
trunk of corpus Callosum
Septum
Genu
Fornix
Splen-
-um
ant. commissure
ant. column of Fornix
lamina terminalis
Thalamus
hypo-
thalams
Optic chiasma
infundibulum
mid
brain
pons
habenular
commisure
pineal body
Post-
commisure
tuber
cinerum
mimillary
body
Floor
Anterior wall
Posterior wall

4th ventricle

- **Definition:** It is the cavity of hindbrain.

- **Connection:** to subarachnoid through central canal of megendi & 2 lat. canal of luschkii.

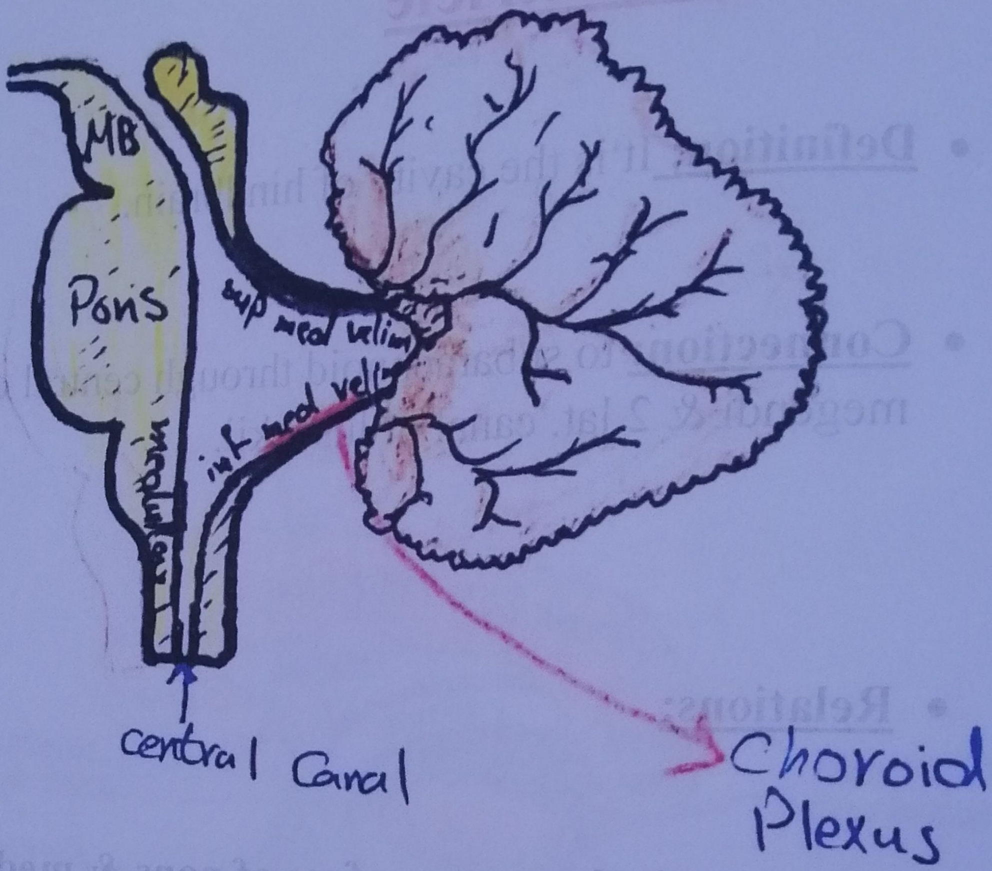
- **Relations:**

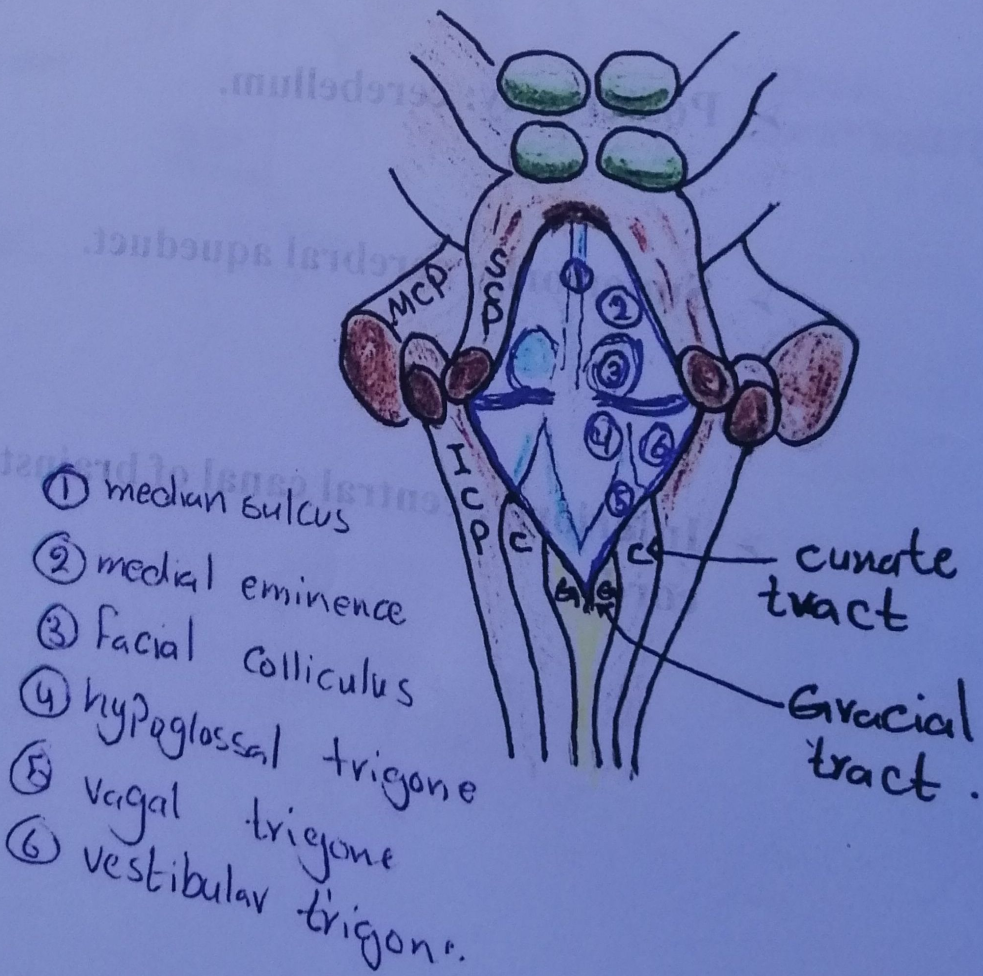
  - **Anteriorly: post. surface of pons & medulla.**

  - **Posteriorly: cerebellum.**

  - **Superiorly: cerebral aqueduct.**

  - **Inferiorly: central canal of brainstem & spinal cord.**


MB
Pons
sup med velum
inf med velum
medulla
central Canal
Choroid Plexus

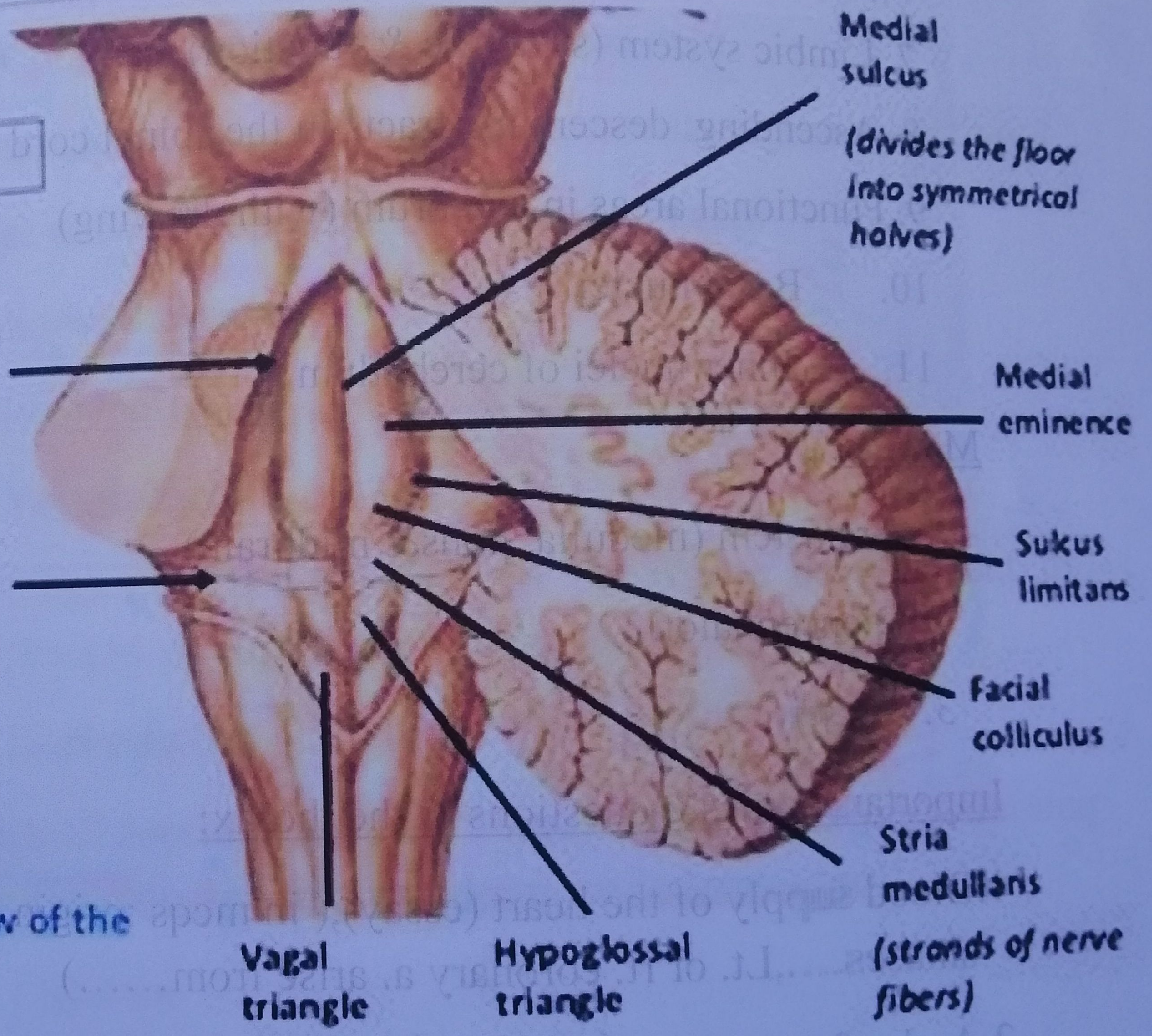

MCP
SCP
ICP
C
C
G
G
①
②
③
④
⑤
⑥
cunate tract
Gracial tract.

① median sulcus
② medial eminence
③ facial colliculus
④ hypoglossal trigone
⑤ vagal trigone
⑥ vestibular trigone.

Floor or rhomboid fossa of fourth ventricle :

Formed by :

1. Posterior surface of the pons
2. Cranial ½ of the medulla oblongata


Medial sulcus
(divides the floor into symmetrical halves)
Medial eminence
Sukus limitans
Facial colliculus
Stria medullaris
(strands of nerve fibers)
Vagal triangle
Hypoglossal triangle

Posterior view of the 4th ventricle

Questions mentioned in the last Lecture:

Important topics& questions in the neruanatomy: Essays in

1. Blood supply of the brain &spinal cord
2. Spinal cord
3. Cerebellum
4. Cerebrum
5. Compare between pyramidal &extrapyramidal tracts (-origin -insertion- function)
6. Internal capsule
7. Limbic system (structure & function)
8. Ascending descending tracts in the spinal cord
9. Functional areas in cerebrum (with drawing)
10. Basal nuclei
11. Inner nuclei of cerebellum

Mcqs in:

1. Brainstem (medulla, pons& midbrain)
2. Diencephalon
3. Nuclei

Important topics& questions in the thorax:

1.Blood supply of the heart (essay),(in mcqs :origin &termination sinuses......,Lt. or rt. coronary a. arise from……)

2.Arch of aorta (beginning, end , b/s)

3. Branches of arch of aorta

4. Internal structure of the rt. Atrium(soft area & openings…)

5.Azygous vein

6.Cardiac n. plexus (superficial & deep)

7. Thoracic duct
8. Diaphragm opening (in mcqs: levels & structures in openings)
9. Trachea & esophagus (thoracic part: beginning ,end….)
10. Bronchopulmonary tree
11. Root of the lungs (rt. &Lt.), ligaments ,b/s & n. plexus

Important topics& questions in the Embryology:

1. Development of neural tube
2. Derivatives of the neural crest
3. Congenital anomlies of the spinal cord

   in congenital anomlies questions, write any abnormal case

   i.e: write the opposite of the normal cases
4. Spermatogenisis
5. Oogenesis
6. Fertilization
7. Cleavage (It's the process of zygote development to morula or formation of morula from the zygote)
8. Implantation

Q/what's morula? It's the 1st implantation in the endometrium before differentiating into ectoderm, endoderm…etc

9. Placenta
10. Amnionic fluid
11. Amnionic sac vs yolk sac
12. Development of the thalamus

Nural tube → forebrain → diencephalon → post.part (thalamus).

13. Development of the tongue

- ✓ Tongue develops from a single tuberclavian part & 2 large tongue swellings 0°0
- ✓ The tuberclavian part elongates while swellings become Smaller
- ✓ Foramina cecum& sulcus are formed &divide th tongue into ant.2/3 &post 1/3

Note: it's developed from 1st ,2nd &3rd pharyngeal arch

14. Development of the face

Nasal bud
Maxillary bud
Mandibular bud
} then they fuse together in the mandible

- ✓ Maxillary cleft: occurs due to failure or incomplete fusion of maxillary bud

15. Development of the nose

16. Development of the heart (tube, verticles, septums with drawing)

17. Development of the respiratory system

18. Development of the liver & pancreas

19. Development of the GIT.

Foregut → (esophagus & stomach)
Midgut → (small intestine)
Hindgut → (rectum........)

20. Congenital anomlies of trachea &GIT